The Story of DDT

CHEMISTRY

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★ A SCIENCE SERVICE PUBLICATION ★

Youth U. S. A. Goes Chemical

➤ THIS YEAR Scientific Young America is chemically-minded. The Editors of CHEM!STRY are in a unique position to report on what Scientific Young America is thinking. They have just read the essays of contestants in the Fourth Annual Science Talent Search for the Westinghouse Science Scholarships.

These high school seniors synthesize and polymerize, although, says one lad, "this isn't as hard as it sounds, or I probably wouldn't have done it." Wartime shortages discouraged some. "Our school doesn't have much equipment, but when I get to college . . . " But the youngsters we are really rooting for report: "I wanted *thus and so.* I couldn't get it, of course, but in a junk-yard I was lucky enough to find . . . "

A motor, an old radio, a formula they read in a book doesn't have the characteristics they require, so they re-design the project to fit what they find at hand, and often come out with something better than they expected. Even when they don't succeed, they have fun and they learn.

All this is accomplished, not in school hours, but on their own, in addition to heavy academic and social schedules. Sometimes they have enthusiastic cooperation from stimulating teachers and sympathetic parents. Sometimes a hen-that-hatched-an-ugly-duckling background shows through between the lines.

But, common to all the essays of the kids who have really done things, is the description of the little hide-away workshop. Sometimes it is in the attic or the garage, usually in the cellar. The lucky ones have water, gas and electricity. Those who don't, use makeshifts.

If designers of post-war housing really want to do something for Young America, they will worry less about Principles of Functional Design and more about a corner for the youngster whose only wish is that he had a lab "where the glacial acetic acid wouldn't freeze."

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From the air, large areas can be covered with poison dust to kill mosquitoes and other insects. This Mediterranean Allied Air Forces photo shows an A-20 light bomber dusting swampland areas in Corsica.

Deals Death to Disease

THE OUTSTANDING new lifesaving chemical of the war so far is DDT, which is short for dichloro-diphenyl trichlorethane.

It has prevented typhus epidemics by wiping out the lice that carry this disease. It has eliminated the menace of insects upon tropic islands where disease carried by insects has been more deadly and damaging than Japs.

Before the war, an insecticide was, to the average layman, something to spray or dust around the house to rid it of flies, mosquitoes or roaches. Most of them, though the layman probably did not know it, were made of rotenone and pyrethrum, substances extracted from tropical roots and poppy-like flowers. The pre-war layman generally knew, too, that the whitish film he sometimes found on apples was an arsenate spray used to protect orchards from insect pests. He may also have known that paris green was dusted on swamps and pools to cut down mosquito breeding.

Then came the war and the need for more food. Victory gardens turned hundreds of thousand of lay men and women into small-scale farmers and brought them face to face with the insect pests that destroy crops. War also brought the threat of deadly, louse-borne typhus fever and mosquito borne malaria to millions of American sons, fathers, husbands and sweethearts. And war stopped the imports of rotenone and pyrethrum for

fighting mosquitoes and insects that destroy crops.

Most of us had no idea how near we were to losing the war against insects and the distaster that uncontrolled hordes of crawling and flying disease carriers and crop destroyers might have brought. While we were giving thanks to our chemists for newer and better sulfa drugs and to other scientists for plasma and penicillin to fight germs, another group of scientists were working quietly behind the scenes to give us weapons against our insect foes.

Origin of DDT

➤ First of these new weapons to be acclaimed was dichloro-diphenyl trichlorethane, nicknamed DDT. It was synthesized in 1874 by a young German chemistry student, Othmar Zeidler, in Strasbourg. He made it almost as a cook might develop a new recipe for a cake or pudding, and he apparently had no idea that his chemical had any insect-killing powers.

DDT was buried in a German Chemical Society report until a few years ago when Paul Muller, scientist of J. R. Geigy, chemical manufacturing firm in Basle, Switzerland, discovered its properties as an insect killer. Even then, it was a crop pest and not human disease that brought DDT out of obscurity. It saved the Swiss potato crop, threatened in 1939 by Colorado potato beetle, and was soon found to have other agricultural value.

The Geigy firm states that its scientists also discovered DDT's power to kill body lice, which spread typhus fever. When the United States entered the war, the Geigy product was brought to the attention of American military and agricultural authorities.

The tale that the first DDT available in the United States was smuggled out of Switzerland appears to be more romantic than true. A quantity of the potent insect killer was sent openly from Basle to the firm's offices in New York as a regular business transaction. It came in the form of the agricultural insecticide, under the trade name of Gesarol. The New York offices did not then know its chemical structure.

Synthesized by U.S.D.A.

➤ The active ingredient was extracted and later synthesized by U. S. Department of Agriculture scientists who tested it in experiment stations all over the country. At the same time, military authorities in great secrecy investigated its anti-louse property.

Today DDT is being produced in large quantities by a number of firms in the United States. Production has expanded to the point where all military needs are expected soon to be met and there is hope that limited civilian distribution for essential needs may soon be possible.

DDT is used as a body-dusting powder and as an emulsion to impregnate clothing in fighting lice and typhus fever. It is active not only against lice and agricultural pests but also destroys mosquito larvae, fleas, flies, moths, roaches, bedbugs and silverfish.

Spray Entire Islands

➤ Troops making D-Day landings in the future may find the beachheads free of disease-bearing mosquitoes and other insect pests, thanks to a pre-landing DDT spraying of the area from the air. This suggestion comes from medical men enthusiastic over

DDT sprayed on 70,000 people each day as shown in this U. S. Army Signal Corps picture quelled a typhus epidemic in Naples.

the results of using the potent insecticide for systematically ridding an entire island in the Pacific of disease-carrying insects.

For the first time in medical history an entire island has been sprayed with DDT. The job was done with a Marine Corps torpedo bomber especially rigged to distribute the solution that sprays death on the insects which in the past have claimed more casualties than bullets have in the Pacific war.

Twenty-two hours after the first planes landed on the battered airfield, a nearly invisible mist of a DDT solution was settling over the rubble-strewn island and its mosquito-breeding mangrove swamps.

The spray, a mixture of DDT in oil, is said to kill every insect on contact.

DDT also has been used on this island in great quantities on the more than 7,000 Japanese corpses counted and buried thus far. And it also is being used in hand sprays around mess halls and latrines, and other areas where dysentery-carrying flies abound.

The DDT is sprayed from pin-hole nozzles in a short length of gas pipe attached beneath each wing of the plane. The makeshift gadget was devised a short time prior to this operation by Navy Comdr. Winslow T. Tompkins (MC), of Iowa City, Iowa, and Marine Lt. Col. Walter T. Brownell, of Tuscaloosa, Ala., formerly chief aeronautical engineer of the Howard Aircraft Company.

Comdr. Tompkins described the problem to Lt. Col. Brownell, his roommate at a rear base, who made a rough pencil sketch. The Seabees did the rest with a piece of gas pipe.

The torpedo bomber was found to be the best plane for spraying the fluid. Flying at 125 miles an hour at an altitude of 150 feet, it sprays 10 gallons of the DDT solution per minute. This island is approximately 6,400 acres in extent and it is estimated two quarts of the solution are sufficient to cover an acre.

The Japanese do not have DDT and rely upon a repellent stick with a citronella base, or else on a punk made of ground red cedar bark, to protect them from insects.

DDT Harmless When Dry

➤ DDT, SCIENCE'S newest and deadliest blitz-weapon against insects, though known to be poisonous to man and warm-blooded animals also, is apparently safe to use when dusted dry on the skin and when breathed in air into which it has been sprayed as an insecticide. Results of two series of experiments supporting this conclusion were presented by Dr. Herbert C. Calvery of the U. S. Food and Drug Administration and Dr. Paul A. Neal of the National Institute of Health.

Dr. Calvery's summation was: "In solid form DDT applied topically to the skin is nonirritating, nonsensitizing and not appreciably absorbed. In solution, either in oil or in organic solvent, it does readily penetrate the skin, is very mildly irritating and a very mild sensitizing agent."

Dr. Neal corroborated his colleague's verdict so far as safety in use as a dry delousing powder is concerned, and added that spray or aerosol solutions containing 1 per cent of DDT were breathed for long periods by rabbits without any tangible ill effects.

Furthermore, he said, "In a clinical laboratory study of three men who had had several months' continuous occupational exposure to DDT in its various forms as an insecticide, an evaluation of the results failed to indicate any definite toxic effects."

Both Dr. Calvery and Dr. Neal reported that in their independently conducted investigations they found considerable difference among laboratory animals in susceptibility to DDT poisoning. Mice were more susceptible than rats, guinea pigs and rabbits, with monkeys and dogs most resistant.

When relatively large doses (well above ordinary insecticide levels) were absorbed through the skin or swallowed, symptoms of poisoning began to be evident. They were principally tremors, a "jumpiness" resembling that of strychnine poisoning, and convulsions ending in death. Autopsies disclosed fatty degeneration of liver and kidneys, or changes in nerve structure.

Dr. Neal concluded that although DDT need not be regarded as dangerous in ordinary insecticidal dusts or sprays, heavy contaminations of foods should be avoided.

Entomologists Assay DDT

➤ DDT HOLDS tremendous promise for usefulness but much study still is needed, according to the American Association of Economic Entomologists.

The first official statement by the entomoligical profession of its attitude toward the new chemical was adopted

The effectiveness of sprays is checked by an actual count of the flies killed.

by 392 delegates at the close of their 56th annual meeting in New York in December. They represented 1600 members, many of whom had contributed to DDT research.

The statement follows:

"We feel that never in the history of entomology has a chemical been discovered that offers such promise to mankind for relief from his insect problems as DDT. There are limitations and qualifications, however.

"Subject to these, this promise covers three chief fields: public health, household comfort, and agriculture. As public health we include control of the insects which carry diseases that have scourged humanity, such as malaria, typhus and yellow fever. Household comfort is taken to cover such things as flies, fleas, bedbugs and mosquitoes. Agriculture includes not only farms, gardens and orchards but forests, livestock and poultry.

"In the public health field DDT insecticides are so much more effective than previous weapons against malaria mosquitoes that for the first time there is a practical hope for eradicating that disease from this country. DDT proved in Italy that it is the first and only practical control for typhus. In the household field its amazing lasting effect promises relief for months from flies, mosquitoes and fleas. In the case of bedbugs, eradication from the American home has become a possibility.

"In agriculture, it is promising against a wide variety of destructive pests. These include most potato insects, many orchard and vineyard pests, numerous vegetable insects, as well as the chief insect enemies of vitally important seed crops. It appears

to be effective against the pink bollworm and outstanding against the Japanese beetle, two of our worst imported pests. It promises also a more practical control of the pests which ravage thousands of square miles of forest, and against many of those which harrass livestock.

"DDT will not kill all the important insect pests. It will kill many beneficial insects which are allies of mankind against the destructive species. Because of its toxicity to a wide variety of insects, its large-scale use might create problems which do not now exist. To illustrate, it is a superior insecticide for control of codling moth on apples, but in some sections at least will kill certain natural enemies and thus release other insects which may then become major problems.

"The research reports emphasize that we have not had time to develop entirely satisfactory mixtures and dosages of DDT insecticides, nor the methods and timing of application for many possible uses. Modern agricultural pest control often requires mixing several materials in combination treatments, and we know little of DDT's compatibility with many of these others. Researches thus far were made with a material which was produced under pressure for military needs, and which is not necessarily the best form for agriculture.

"We do not know enough about effects on plants, animals and soils. While most plants were not harmed by DDT insecticides in the experiments, injury to squash, corn, tomatoes and possibly fruit trees was reported. DDT is toxic to animal life when large amounts are taken internally or absorbed through the skin from oil solutions, but reports indicate a reasonable margin of safety. In the light of our present knowledge, heavy deposits on edible parts of plants should be avoided. Reports show definite toxicity to cold-blooded animal life including fish and frogs. There has not been time to learn the possible cumulative effects on soils.

"More and larger-scale experimentation is needed. Enough DDT for such research in 1945 should be provided."

Toxic to Fish and Frogs

➤ DDT HAS BEEN found to be more poisonous to cold-blooded animals such as fish and frogs, than to mammals, in experiments performed at the University of Missouri Medical School by Prof. M. M. Ellis, Dr. B. A. Westfall and Dr. M. D. Ellis.

A practical significance of this investigation is hinted in their concluding paragraph, in which they suggest that it is "of interest in connection with the proposed use of DDT in regions where malaria is endemic against the larvae of the mosquito vectors of that disease." In plain English, this means that wholesale spraying of swamps and ponds with DDT can be expected to kill a great many fish, frogs and other cold-blooded animals, as well as the insects at which the poison barrage is particularly aimed.

DDT Paint Kills Flies

➤ DDT BIDS FAIR to become a regular ingredient of interior paints and wall finishes, as a means of automatically ridding houses of flies and other pests. Experiments indicating this as a practical possibility are reported in a communication to Nature (London), by

two British paint chemists, G. A. Campbell and T. F. West.

Tests were first made with wire-screen cages, in which were placed plywood panels that had been coated with an oil-bound water paint containing 5 per cent of DDT. Flies confined in these cages were all killed. Repetitions of the test after two months showed that the DDT-loaded paint was still lethal to flies.

Further tests were made on a larger scale by painting the walls of small rooms with the same material, except that the mixture was by accident made only one-tenth as strong in DDT—0.5 per cent instead of 5 per cent. Despite the greater dilution, the DDT in the paint killed 90 per cent of the flies that roosted on the walls and ceilings overnight.

Harder finishes, like ordinary oil paints and synthetic varnishes, have thus far not proven successful as carriers of DDT, the two researchers report. This negative result they ascribe to the tighter adsorption of the oil film. They are, however, continuing their experiments with these types of coatings.

Effective Against Codling Moth

➤ DDT, THE NEW insecticide that is attracting so much attention, may prove to be a good substitute for lead arsenate against codling moth in New York apple orchards is suggested by results of tests made this past season by Prof. S. W. Harman, entomologist at the New York State Agricultural Experiment Station, Geneva, N. Y.

Used at the rate of approximately 13 ounces in 100 gallons of water, DDT gave as good control of codling moth in a McIntosh orchard as 3 pounds of arsenate of lead in 100 gallons, the standard spray mixture. Larger amounts of DDT may prove even more effective than the arsenical. The addition of a quart of oil to the DDT spray increased its effectiveness considerably. A 3 per cent DDT dust gave some protection, but it was not nearly as effective as the spray. It is thought, however, that dusting with DDT might be more effective if done in the late evening and with the incorporation of a small amount of oil.

Aside from some browning of the foliage late in the fall, there was no apparent injury from any of the DDT sprays or dusts tested. The cause of the browning has not been determined, but it was definitely found not to be due to destruction of the chlorophyll or to the presence of the red mite which was at first suspected of causing the browning effect. Little or no visible spray deposit remained on the fruit treated with five cover sprays of DDT, whereas the lead arsenate sprayed fruit showed considerable residue. At present the cost of DDT treatment at the above concentration is little more than that of lead arsenate.

Undoubtedly, DDT will not be used extensively on fruit until after a tolerance has been established, but there are indications that the residue is less objectionable than that of lead arsenate.

Naples Typhus Control

➤ THE CONTROL of the typhus fever epidemic in Naples is one of the most outstanding achievements of modern preventive medicine, Brig. Gen. Stanhope Bayne-Jones, deputy chief of the preventive medicine service in the Office of the Surgeon General, U. S. Army, and director of the United States of America Typhus Commis-

sion has reported to the National Academy of Sciences.

"At devastated Naples in 1943," he related, "typhus began to spread in an environment that contained all the elements which from ancient times have favored typhus, namely, war, undernourishment, crowding, disorganized services, lack of the means for keeping clean, and a non-immune population with a high degree of infestation with lice.

"In this setting the ancient pestilence associated with war and human misery was attacked successfully by new weapons which were largely the product of wartime research and by militarized preventive medicine."

The new weapons were the vaccine used by U. S. Forces, new insecticides, chiefly DDT, and new methods of applying DDT powder to destroy lice.

The vaccine is a suspension of killed typhus fever germs which had been cultivated in the yolk sac of embryonated chicken eggs.

"The U. S. Army experience with this vaccine and field studies carried out by the U. S. Public Health Service and the U. S. A. Typhus Commission clearly show," Gen. Bayne-Jones stated, "that proper administration of this vaccine probably protects against infection, greatly modifies and ameliorates the disease if and when it occurs in a vaccinated person and appears to prevent death from typhus.

"There have been fewer than 50 cases of louse-borne typhus in American soldiers vaccinated against typhus and no deaths. A similar, but not identical result has come from studies of the efficacy of the vaccine in civilians in certain countries abroad."

DDT in the form of 10 per cent powder in porophylite kills lice in from two to six hours. While it does not kill louse eggs, it persists in clothing and kills the young insects as soon as they emerge from the hatched eggs. It persists as an insecticide for at least a month and can be dusted into clothing by hand- or power-driven dusters. Persons can be deloused with their clothes on, making unnecessary the cumbersome establishments for undressing, bathing and steam sterilization of clothing familiar to veterans of the last war. Thousands can be deloused by a few persons and in the same time and with far less effort than a few hundreds could have been before the discovery of the properties of DDT and how to use it.

About 40 cases of typhus a day were developing in Naples among civilians near the peak of the epidemic, with a death rate varying from 4 per cent to 54 per cent, depending on the age of the patients. Up to the end of May, 1944, there had been approximately 2,000 cases in the civilian population, but at most two cases in miliary personnel.

The epidemic phase was definitely over within a month after thorough operation of modern control methods. Gen. Bayne-Jones reported. The control program consisted of seven main divisions. Of these the essential starting point and guide was finding cases and isolating them in their homes or hospitals under a "protective sprinkling" of DDT louse powder to cut off infection at the source. Delousing of intimate and remote contacts of patients both in buildings and air raid shelters seems, according to the charts of the epidemic, to have turned the tide, although mass de-

lousing was later done, as was immunization with typhus vaccine of a few thousand essential civilian personnel.

Malaria Control in South

▶ DDT MAY SOLVE the problem of malaria control in rural areas of the South, it appears from a test conducted by the U. S. Public Health Service in Arkansas. Results of the test, called "striking," were reported by Dr. F. L. Knowles, senior bacteriologist of the office of malaria investigation, U. S. Public Health Service, at the meeting of the American Association of Economic Entomologists.

A widespread federal campaign, to combat the threat of malarial flare-ups resulting from the return of service men who have contracted malaria overseas, is expected to get under way as soon as sufficient DDT becomes available.

DDT supplies "will remain very tight through March and possibly April," John A. R. Rodda, in charge of insecticide allocations in the War Production Board, told the entomologists. "We are still working on military needs, which are consuming practically the entire production. Besides, the raw materials for manufacturing DDT have become critical and are granted only because of the military needs for DDT."

Describing the Arkansas DDT tryout in malaria control, Dr. Knowles pointed out that malaria is an unsolved problem in the southern states because regular control methods are too expensive.

"Spraying the insides of the houses is more effective. The unique residual toxicity of DDT should make it still less expensive and more practical.

"We picked 36 square miles in Arkansas near Helena. This is cotton country. Ninety-five per cent of the houses are of tenant or share-cropper type, shotgun-construction, newspaper lined, inhabited by Negroes making only a marginal living. With two high school boys we sprayed the insides of these last summer, leaving every 25th house unsprayed as a check.

"Daily inspections of the sprayed houses throughout two months after spraying showed that for that long a period, there was a 94 per cent average reduction in the number of mosquitoes resting, alive, on the indoor walls."

What happened, he said, was that the mosquitoes came indoors at night, alighted on walls and ceilings bearing an invisible residue of DDT, and were fatally poisoned. This effect takes several hours, but is rapid enough so that "there was an average 80 per cent reduction in number of living, resting mosquitoes from early morning to afternoon."

This technique, it was added, hits the mosquitoes at the strategic time: the night, when they are lying in wait indoors to bite sleeping victims.

The job used an average of .82 of a gallon per house of five per cent DDT solution. Per house it consumed 10 minutes, took .73 of a man-hour, and cost 74 cents for material and labor.

DDT Costs 60c lb.

▶ DDT HAS BEEN reduced 40 per cent in cost since July 1944 by the DuPont Company. Its new plant in Grasselli, N. J., is now producing the insecticide at a rate two and one half times designed capacity.

When scarce DDT was required so urgently a year ago for typhus control in Italy that 500-pound cargoes were flown overseas from the Du Pont pilot plant in Cleveland, Ohio, the cost was $1.60 per pound. Commercial production at the New Jersey plant, rushed to completion in record time, brought the price down to $1. Effective January 1, 1945, the cost to the Army and Navy was reduced to 60 cents per pound. Process improvements combined with the production increase permitted the price reductions.

"Fingerprinting" Gasoline

➤ BLACK MARKET and stolen gasoline can be identified and traced back to the storage tanks or supply sources from which it was taken by a new method devised by the Federal Bureau of Investigation.

The "fingerprinting" of gasoline is done by putting a substance into the fuel that can later be identified. The substance added can not be noticed just by looking at it; the gasoline appears just the same as any other gas. But when a sample of the "hot" gas is taken out of an automobile tank and taken to the laboratory for examination, another chemical can be added that will make the first one change color or flash some other warning signal.

There are a number of such indicators used that are different from any substance found naturally in gasoline, that cannot be detected by observation alone, and that will not interfere with the working of the engine.

The FBI laboratory has also investigated the use of anthracene or other materials that do not show up in ordinary light, but that glow when placed under ultraviolet. The trouble with such substances is that any naturally fluorescent ingredient in the gasoline would interfere with their use.

Journals For Latin-America Wanted

➤ SCIENTISTS in the United States are collaborating with their Latin-American colleagues in making available files of journals for new and active institutions where the lack of adequate library facilities has greatly impeded research.

Already the libraries of two such institutions have been implemented by the addition of journals. The Committee on Inter-American Scientific Publication, headed by Dr. Harlow Shapley, director of Harvard Observatory, is now collecting journals for a number of other Latin-American institutions.

Scientists who have unused files of journals which they are willing to contribute are invited to communicate with the Comité Interamericano de Publication Cientifica, Harvard College Observatory, Cambridge 38, Massachusetts.

Knowledge is Accumulating But Analysis Fails to Tell Full Food Story

The Chemist and Nutrition

by E. B. Hart, *Professor of Biochemistry, University of Wisconsin*

Reprinted from *Nutrition Reviews*, February 1945

At the turn of the century it became increasingly evident that the chemist could help little in evaluating a food from the standpoint of nutrition. He was able to make a limited number of estimations such as crude protein, crude fat, fiber, and ash, but beyond their value for feed and food control laboratories such determinations contributed little to our knowledge of the nutritive value of foods.

The nutritive value of the food must be determined biologically; "test it on the cow or pig," and later "test it on the rat" was the usual procedure.

With the gradual unfolding of the chemical character of the many factors involved in mammalian and avian nutrition and the accumulation of knowledge of species requirements as well as differences in requirements, the possibility of referring the question of nutritive value to the chemist again arises. The picture is incomplete. We do not know all of the requirements either qualitatively or quantitatively; all of the nutritive factors have not been chemically tagged. Nor do we have chemical and physical methods for the determination of all of the known nutrients, but distinct progress in that direction is being made. To illustrate, vitamin D is at present estimated only by biologic methods but it is reasonable to expect that this important nutrient will be estimated ultimately by physical and chemical procedures. Control laboratories are already at work on this problem.

The nutritive value of proteins is based on the retention of nitrogen by the animal but it is altogether probable that before long tables giving the amino acid content of the total protein of a foodstuff will be made available. Today we have incomplete tables showing the amino acid content of individual proteins as well as the proteins of animal tissues and certain plant tissues. When such data are more complete, made possible by the rapidly developing microbiologic methods, the chemist should have in hand valuable tables for a decision of protein values in nutrition. What will be needed in addition to composition will be tables showing the species requirements for various functions such as maintenance, growth, reproduction, and lactation. Such data are also being slowly accumulated.

There may, however, be several stumbling blocks for the chemist's dream as outlined above. The question of availability may enter. Will the animal require more of an essential amino acid than that registered for a foodstuff as determined by chemical or microbiologic methods? It is possible. The enzymes of the tract may not readily loosen all of a particular and essential amino acid for ready absorp-

tion, with partial loss in the fecal residues. Again some destruction of an essential amino acid may occur in the intestine and thus lower the availability. These are untouched problems but capable of solution.

The proteins of the soybean may show an excellent quantitative array of amino acids yet only when heated will the members of the sulfur complex become available.

The availability of phosphorus is another illustration. In certain food materials, especially where they have been heated and the accompanying phytase destroyed, the phosphorus of phytic acid may show a low availability. In certain plant materials the calcium exists in part as an oxalate, an insoluble and unavailable source of calcium. Consequently a determination of the total calcium will not give the true biologic value of that calcium. A striking illustration of the same phenomenon exists where iron in some food materials will show high availability of the total iron, while in other instances this availability may be reduced to 25 per cent, as is the case of spinach.

Even a "water-soluble" vitamin such as thiamin is held so firmly in live yeast that not until after the death of the cell will this nutritive factor become available to man. Such phenomena may cloud the chemist's ability to make a primary and final decision as to the nutritive worth of a food material unless the tables are accompanied by data on availability. This should eventually be possible.

The influence of food upon the rate and kind of intestinal synthesis is a problem under active investigation. It is an old observation that a high lactose diet will tend toward the maintenance of an aciduric flora in the tract while other diets free of lactose may encourage the development of an entirely different flora. Further, what synthesis of essential nutrients is made will be influenced measurably by the type of organism inhabiting the tract. After all it is becoming more and more apparent that nutrition consists of what the food supplies and in addition what important nutrients may be contributed by intestinal flora. Further, while we think of accretions through synthesis, the problem of destruction or alteration of nutrients will demand study. This phase of the problem is important for aging human beings.

That the type of carbohydrate ingested can influence the flora is well established by lactose feeding but even among other carbohydrates, such as starch, sucrose, or glucose, profound influences on the type of intestinal organisms may be effected. Of course one may doubt the significance to man of studies with special diets and single carbohydrates but nevertheless the problem is there. We may then ask the question, what assurance have we that a table listing only the carbohydrate or the "available" carbohydrate will give the chemist the necessary data for a food evaluation. Certainly it appears that here is a tremendous field for further investigation and the same kind of questioning is accumulating about the fats. On a lactose diet corn oil in a caloric equivalence is not the equal of butterfat in the nutrition of the rat. But on a glucose diet it is. On the lactose-corn oil diet the rat will suffer from an initial diarrhea. On the lactose-butterfat there is no diarrhea. These are profound effects

of special experimental diets and an attempt to catalogue them in a chemist's table may not be possible—but certainly not hopeless. Only after much more work has been done, and especially with human subjects, can the significance of fat, carbohydrate, and even protein relations to intestinal function be laid bare.

Perhaps there will be no greater stumbling block to the successful use of the chemist's tables than the acceptability of a food by the consumer. He must like the combinations no matter how rich the material may be in specific and necessary nutrients. Some individuals like tomato juice, others do not. Yet the product is a well known rich source of vitamin C. Such individual preferences find their greatest application in the prepared Army rations. Some of these rations may not be palatable or acceptable to all soldiers, yet from a chemist's table they will carry all the essential nutrients. In feeding soldiers under special service conditions the question of acceptability is one of importance but need in no way check the development of the thesis here propounded, namely, that eventually tables may be constructed by the chemist setting forth the quantitative content of essential nutrients—their availability, their influence on intestinal behavior including synthesis, destruction, and absorption.

Surely in civilian life and where free choice of foods will again prevail, the distasteful can be replaced by the tasteful and yet provide amply the essential nutrients. The chemist's tables can be made useful—but only after much more knowledge is accumulated.

Penicillin-Like Substances in Plants

➤ PENICILLIN-LIKE substances, hostile to germ life, may be found in leaves, fruits and other organs of a wide range of higher plants, as well as in lower plants like the molds, bacteria and algae that have until now been their only known sources. Evidence on this point is offered by E. H. Lucas and R. W. Lewis, research workers at Michigan State College of Agriculture and Applied Science, East Lansing, Mich.

The two men found antibiotics (germ-stopping substances) in the leaves of Scotch thistle, mullein and peony, and in the fruits of blueberry, currant, mountain-ash and honeysuckle. One species of honeysuckle even had two distinct antibiotic substances in its berries.

Not all plants, however, yielded extracts with antibiotic properties. Only negative results were obtained from horseradish, turnip and several varieties of cabbage.

The two investigators were induced to undertake their research by two hints in existing botanical knowledge: (1) actively growing and functioning zones of roots are normally able to keep up their activities despite the presence in the soil of germs known to be capable of killing them; (2) folk medicine (usually regarded as more or less superstitious) prescribes a great variety of plant extracts, poultices, etc., as "good for" many kinds of infection.

"The results obtained so far indicate

that a wide field is opening up for exploration," the report says. "In all probability, the problems to be encountered will be of a general biological nature rather than being confined to the inter-relations between bacteria and higher plants. Broader aspects are coming into the picture, heretofore merely touched but not yet developed."

Reprinted by courtesy of NEA Service

"Teacher told us science will rule the world after the war, Mom, so we're just experimenting on ways to make spinach and carrots taste better."

American Chemical Society Committee Offers Vocational Guidance

The Scope of The Chemical Field

Reprinted from a pamphlet of the American Chemical Society

FOR THE GUIDANCE *of students interested in preparing for the chemical profession, a statement entitled: "Vocational Guidance in Chemistry and Chemical Engineering" has been prepared and distributed by the American Chemical Society. First issued in 1939, and now revised by a committee consisting of Roger Adams, W. G. Whitman, and W. T. Read, chairman, this presentation is being published in* CHEMISTRY *because of its usefulness not alone to students but to everyone interested in chemistry. This article consists of the first third of the committee's statement and the rest of the report will appear in the issues of* CHEMISTRY *for March and April.*

CHEMISTRY is the fundamental science that treats of the composition of substances and of the transformations which they undergo. These substances are elements, their mixtures, and their compounds. While the ancient peoples were aware of such common elements as iron, copper, silver, gold, lead, mercury, sulfur, and carbon, they did not recognize them as such but thought fire, earth, air, and water were the fundamental substances from which all else was made.

Following a period in which alchemy flourished, Robert Boyle published a book in 1661 in which he recognized and defined the terms "mixture," "compound," and "element." Dalton in 1807 proposed the atomic theory which facilitated the discovery of elements. When Mendeleeff propounded the Periodic Law and devised his Periodic Table in 1869, 56 elements had been discovered. It is now known that at least 92 elements exist, and of these 90-have been identified.

Chemistry as applied in industry in this country goes back to Colonial times because such operations as soap making, tanning, and dyeing, often conducted as home industries in those early days, are chemical processes. The chemical industry developed in this country very much in the same way as it did in Europe except that very few such synthetic organic chemical products as drugs, intermediates and dyes were made in any significant quantities.

World War I emphasized the importance of the possession by the United States of a complete, well-rounded, and independent chemical industry. With the incentive supplied by the cutting off of European imports synthetic pharmaceuticals and synthetic dyes were made in this country's own plants in ample quantities. The needs of agriculture were soon met by the development of a synthetic nitrogen fixation industry and the utilization of American supplies of potash.

The period between the two great wars saw great progress in many fields of chemical industry. New materials were developed, natural products were

either supplemented or displaced by synthetic substances, and old and well-established fields were greatly expanded.

Thus World War II found the United States prepared to meet the enormous demands which global war immediately imposed upon chemical industry. The productive capacity of magnesium was increased a hundred fold and that of aluminum, already large, seven fold. Synthetic rubber of certain specialized types was being produced at the rate of a few thousand tons per year when imports were largely cut off by the Japanese in the Pacific. Within less than three years this country was making synthetic rubber at a rate *much* greater than our previous rate of importation of natural rubber. The petroleum industry developed production of aviation gasoline in astronomical proportions a feat which contributed greatly to the success of our forces and those of our allies. Many new plastics and synthetic resins were perfected. What is generally termed "the heavy chemical industry" was greatly expanded. The petroleum industry was called upon to supply toluene previously obtained from coal distillation, and large quantities of this substance so vital to our explosives program have been produced from petroleum distillates. New members of the family of sulfa drugs, discovered shortly before the beginning of the war, have been developed for special purposes. Penicillin, a biological product, is made on a large scale by the utilization of chemical engineering equipment and methods. The production of the insecticide, D.D.T., in large amounts has aided greatly in protecting troops against insect-borne disease. The recent synthesis of quinine holds great promise for further independence of the American drug industry of foreign supplies. Many other new products needed for carrying on the war have been developed and many more discoveries have been laid aside at the laboratory stage for further development with the coming of peace.

Chemistry and chemical engineering have steadily penetrated into other related industries, controlling processes, standardizing products, developing the utilization of wastes, and serving in many other ways.

A very large proportion of the men and women in the chemical profession in the United States are directly connected with industry; in fact, nearly every basic industry is represented in any survey of chemical occupations.

Chemistry resolves itself into two fundamental fields—organic and inorganic—both of which have many subdivisions. Organic chemistry is the chemistry of the carbon compounds and is also known by that designation. Inorganic chemistry embraces the non-carbon compounds. Physical chemistry deals quantitatively with the relations between the chemical and physical properties of substances, both organic and inorganic, and their composition. Brances of physical chemistry include colloid chemistry and electrochemistry. Analytical chemistry is the procedure for determining the composition of substances and therefore it provides controls for all types of chemical operations. Biochemistry deals with chemical compounds and processes occurring in plants and animals and with the influence of chemicals on vital processes.

Chemists and chemical engineers

are members of the chemical profession in a broad sense, since both must possess a sound training in the principles of chemistry. Both must also have mastered the fundamentals of physics and mathematics. With this common beginning the two branches of the chemical profession diverge.

The chemist frequently is engaged in both control and research laboratory work. He deals first with grams and milliliters and his tools are the buret, the beaker, the balance, and instruments of precision. He thinks in terms of reactions, of equilibria, and of catalysis. His efforts are directed to discovering new materials or processes which show promise of having industrial application. He must then modify his laboratory developments so that they may be adaptable to semi-works operations at which point the chemical engineer is called in to assist in the larger-scale production. The chemist is the chief source of knowledge from which result new basic reactions, improved analytical methods, procedures for control of manufacturing processes and more broadly the widening of the frontiers of chemistry and the expansion of the chemical industry.

The chemical engineer is interested in reactions, equilibria, and catalysis primarily from the point of view of their industrial applications. He is concerned more than anything else with the application of chemistry and the various branches of the engineering sciences to the design, construction, operation, control, and improvement of equipment for carrying out chemical processes on an industrial scale. He handles tons and thousands of gallons. He deals mainly with unit operations (mechanical, electrical, and phase-change separation, crushing, grinding, dissolving, etc.), the flow of materials, and the transfer of energy. His tools are typified by the pipe wrench, the pressure gauge, and the recording meter. He thinks in terms of continuous processes and maximum yields at minimum cost.

Unit processes, or types of chemical reactions, characterize every chemical manufacturing operation. The term "process industry" has been applied to every industry which depends to any important degree on chemical change. For example, oxidation is a unit process whether it is employed in the manufacture of sulfuric acid from sulfur or the formation of nitric acid from ammonia. Reduction, halogenation, nitration, and sulfonation—all are unit processes. The chemist studies them and masters their intricacies in making new substances and devising new processes for old ones. The chemical engineer classifies all manufacturing operations according to their predominating unit processes as well as their major unit operations, and he designs and operates equipment by which these unit processes are most safely and efficiently carried out on a large scale.

Only by cooperation of the chemist and chemical engineer can new developments be applied most expeditiously. Adequate knowledge of chemical engineering by the chemist and of chemistry by the chemical engineer is recommended. In plants where the technical staff is limited, it is not uncommon to find either the chemist or chemical engineer devoting part of his energies to work usually done by the other.

Among the main industrial fields open to chemists and chemical engineers are these:

Alcohols and related products
Biologicals and vitamins
Ceramic industries, including clay products, refractories, glass, and enameled metals.
Coal and coal products, including products of by-product coking operations
Cosmetics and perfumes
Explosives
Fertilizers and agricultural and household insecticides
Food and kindred products
Gas, manufactured and natural
Inorganic heavy chemicals, including inorganic acids, alkalies, salts, chlorine, etc.
Leather and glue
Lime, cement, and gypsum
Medical and clinical chemistry
Oils, fats, waxes, natural resins, and their products, soap, glycerin, fatty acids
Organic chemicals such as dyes, intermediates, many pharmaceuticals, and fine chemicals
Paints, varnishes, and lacquers
Paper, forest products, and naval stores
Petroleum and its products
Pharmaceuticals
Photography and photographic supplies
Public health, water, sewage, and sanitation
Rubber, natural and synthetic
Starch, sugar, and gums
Synthetic fiber technology
Synthetic resins and plastics
Textiles and their products

Explosive More Powerful Than TNT

➤ A SMALL QUANTITY of the explosive now carried in American rockets will blow a two-inch hole through five feet of reinforced concrete, states Maj. Gen. L. H. Campbell, Jr., Chief of Ordnance, in a report in Army Ordnance magazine. Called "pentolite," the new explosive is 20 per cent more powerful than TNT.

Pentolite is made by nitrating an alcohol which, in turn, is made by treating a mixture of formaldehyde and acetaldehyde with lime. It can be heated below the boiling point of water and poured into artillery shells used for demolition work. It is also used as a booster, detonator, or filler in various other kinds of projectiles, including rifle grenades and antitank projectiles. It was employed to help clear the wrecked harbor of Cherbourg, France, Gen. Campbell reports.

Grandfather of Pentolite is PETN, or pentaerythritol tetranitrate, which was invented in 1891. Alone, PETN is 40 per cent more powerful than TNT. Experiments conducted at Picatinny Arsenal at Dover, N. J., during World War I led experts to believe that PETN was too dangerous to manufacture because of its sensitivity to friction. However, by mixing the high-explosive PETN with the less-explosive TNT, they were able to produce safely a superexplosive, not as powerful as PETN, but more powerful than TNT.

Chem Quiz

Who Was He?

_____	Reaction	_____	Hypothesis
_____	Prism	_____	Metal
_____	Salt	*Bunsen*	Burner

Each of the five blanks represents the name of a man. Each phrase is one familiar to chemists, like the example given at the end of the list. You are more apt to know what these men are famous for than to know details of their lives.

The Man	Dates	Nationality	Occupation	Famous in Field of	Your Score
A	1799-1862				
B	1604-1668				
C	1871-1935				
D	1768-1851				
E	1785-1850				
Bunsen	1811-1899	German	Prof. Chem.	Flame & Heat Study	?
Score	20	15	10	5	

The letters A B C D E represent the names of the scientists necessary to complete the phrases at the head of this Quiz, but are arranged in a different order. If you can guess the names and identify them by their life dates in the above table, give yourself a score of 20 for each, a total of 100%. If you cannot identify them, turn to page 33 for additional data.

The world production of plastics, now replacing metals as a war measure, is only about one-quarter of one per cent the output of steel.

During the 1940-43 period, the number of acres in the United States devoted to crops increased about 4 per cent, but the amount of commercial fertilizer used increased 36 per cent or over.

Metallurgical plants in the Donets Basin and Don regions in Russia have now been rehabilitated and are producing daily thousands of tons of iron, steel and other metals for munitions to defeat Hitler.

Diamonds, Perfume and Nylon

➤ DIAMONDS sparkled, perfume sent its gentle fragrance through the room and nylon stocking were encased in a locked display case. The label on these was "coal."

Since diamonds are made of carbon, one of the principal elements in coal, brilliant cut stones highlighted the "black magic" on exhibition. A pair of real nylon stockings, made of coal, water and air, was marked, "authentic nylons, circa 1939."

A perfume bar gave guests an opportunity to compare the odors of roses, carnations, gardenias, and violets, while a chemist showed how they are mixed individually. Lilacs and lily-of-the-valley perfumes as well as the woodsy and bouquet types all result from the chemist's utilization of coal tar to reproduce nature's product.

A table with a coal-finished top that will not burn was offered to the guests for use as an ash tray, and a fabric made spot-resistant by a coal treatment was demonstrated. Plastics at the show included a picture frame, woman's handbag and compact.

A few of the 10,000 colors and shades of dyes made from coal were shown. The red of a woman's lipstick and the black of her mascara, as well as part of the shine on a man's shoes, are derived from coal.

The display was arranged in New York by the Bituminous Coal Institute which wanted the public to know that coal is used for something besides burning.

Metals "Strained" From Wastes

➤ A NEW CHEMICAL "STRAINER" recovers chromium, gold, platinum, molybdenum, vanadium and palladium from industrial water solutions formerly wasted for lack of an economically feasible recovery method.

Chemists of the Permutit Company described the new method before the American Chemical Society's eleventh annual chemical engineering symposium.

The new process employs a form of anion exchange resin. In the case of gold, platinum or other high value metals, after they have been absorbed, the resin is "ashed" or burned, reclaiming the metal in practically pure form. In the case of low value metals such as chromium, the metal is recovered from the resin, after absorption, by use of a chemical regenorant, usually an alkaline solution, thus providing a solution as much as 30 times stronger than the original waste.

The latest use of ion exchangers, as developed for water treating purposes, not only can salvage wastes now lost to the war effort, but will also aid in reducing stream and harbor pollution in the vicinity electro-plating and other metal working plants.

Bagasse, or what is left of sugar cane when the juice is extracted, can be used for fuel, building and insulation material, raw material for alpha-cellulose, plastics, decolorizing char and other industrial purposes.

Government Chemists Develop New Method of Using Corncobs

Farm Wastes Yield Sugars

➤ A NEW METHOD to convert farm wastes, like corncobs, into sugars used in many industrial processes has been developed by government chemists.

It is a continuous process, with acids, which makes use of the special chemical and physical properties of farm wastes or residues. Chemistry is transforming such residues into money for the farmer, and a rich "bank" of cellulose reserve against the day when many natural national resources are depleted.

J. W. Dunning and E. C. Lathrop of the Northern Regional Research Laboratory, U. S. Department of Agriculture, Peoria, Ill., explain the process in the American Chemical Society publication, Industrial and Engineering Chemistry (January 1945.)

These wastes represent an annual cellulose reserve, they point out. It is estimated that 100,000,000 tons of such residues might be available in this country for industrial purposes each year, with an equal amount left on the farms for plowing back into the soil. In view of the decrease in irreplaceable natural resources, it is becoming clear that at some period all countries must look to products of annual plant growth for the production of many materials now derived from other sources.

The Peoria laboratory is seeking means of using such residues not mainly as substitutes but rather as raw materials that can do industrial duty better than other raw materials.

Wood wastes have been considered the logical material for lowest-cost manufacture of fermentable sugars—needed for such things as industrial alcohol. But even wood sugars have not been competitive in cost with blackstrap molasses as a fermentable sugar source.

The bulkiness of most farm wastes, their higher content of pentosans—a complex carbohydrate—and lower cellulose content as compared with woods heretofore have prevented considering them as a source of raw material for sugars, the report said.

The researchers reasoned that what might be needed in utilization of farm wastes for sugars is some "added ingredient" which would be produced concurrently and command a higher price than fermentable sugars.

"This might be furfural, now manufactured to the extent of about 20,000 tons a year, or xylose (a sugar) which has potential uses if priced near sucrose. Both of these chemicals are derived from pentosans which generally occur in higher amounts in agricultural residues than in wood."

Working with corncobs, sugar-cane bagasse, flax shives, oat hulls, and cottonseed hulls, the chemists developed a continuous, two-stage process in which the pentosans in the wastes first are hydrolyzed or decomposed by dilute sulfuric acid. Then the cellulose is turned to sugar by a new concentrated acid method which uses less

than one-fourth the amount of acid required by other known concentrated acid processes. Lignin remains as an insoluble residue.

The pentosan hydrolysis yields a 15 to 20% xylose solution, and the cellulose hydrolysis yields a 10 to 12% dextrose solution.

Carotene Necessary for Cattle Reproduction

➤ CAROTENE, the yellow pigment in such vegetables as carrots and rutabagas, present also in green leaves of all kinds, has been found essential to reproduction in dairy cattle, in researches conducted at a number of state experiment stations, as well as at the U. S. Department of Agriculture's great experimental farm at Beltsville, Maryland.

When carotene is lacking in the ration during the reproductive cycle, dead, paralyzed, and weak calves result. Cause of the paralysis in the calves is a degeneration of the nerve tracts of the spinal cord. Some cattle go blind when deprived of sufficient carotene.

The vitamin A content of milk is considerably lowered during the winter feeding season as compared to milk produced on pasture, due largely to lack of carotene in hay and dried fodder. Carotene is needed for the formation of vitamin A. Whether or not dairymen will be asked to increase the vitamin A content of the winter produced milk in market milk areas after the war remains to be seen. The American Medical Association has expressed interest in the subject. It seems doubtful that such increase can be accomplished by using field-cured hay. The use of grass silage offers some possibilities in this direction.

Amount of carotene necessary to bring vitamin A potency of winter milk up to that of summer milk is about 600,000 to 700,000 international units of carotene per day. In order to produce the same effect with vitamin A per se, an intake of 250-300 international units is required, results at the Purdue Agricultural Experiment Station indicate. The cow is not a very efficient user of either carotene or vitamin A, since only from 1 per cent to 3 per cent of the vitamin A or carotene fed actually appears in the milk.

Commercial products containing vitamin A have recently appeared on the market which are supposed to increase milk production. The first one developed was tried extensively at the Walker-Gordon farm in New Jersey with apparently good results. Increases of four pounds of milk per cow per day were reported. Preliminary data on this product have been obtained at University of Maryland.

Synthetic liquid fuels will be subjected to research and development in a new government laboratory to be erected near Pittsburgh; the plant, occupying seven acres, will be ready for use late in 1945.

Benzol, coming into wider use as a fuel for internal combustion engines, is a clear, colorless, highly inflammable liquid distilled from coal tar, a by-product of coke ovens, or taken from coke-oven gas by passing it through oil.

Better Robombs, Rocket Clips, New Jet Planes on Way

U. S. Rocket Warfare to Blossom Soon

by ROBERT N. FARR

➤ GERMANS and Japs are in for a few rocket surprises soon. Rockets that are a great improvement over anything that Nazi scientists have been able to produce will be used in action against the enemy by the United States and the Allies.

The "Yankee Doodle" robomb, now being carefully tested by the Army Air Forces, may prove itself more accurate than the German V-1, in which case it will go into mass production and be launched against the Axis. The Nazi flying bomb was a last-ditch defensive weapon, which has been only partially effective, and as such is unsuitable for our use. However, we have taken the basic idea of the V-1 and molded it into the Yankee Doodle robomb, which this year may be used for precision bombing attacks on Tokyo and on German cities, resulting in greater havoc than the Nazis were able to accomplish in London and Paris or against concentrations of Allied troops.

Rocket launching tubes may become a part of the wing structure of American warplanes this year, with the tubes built into the wing, instead of being fastened on outside as they are today. Mounting rocket tubes in the wing itself will eliminate the drag caused by the externally mounted tubes, thus increasing the speed of the airplane and making it easier to maneuver. New types of rockets that are more powerful will probably be launched from our planes this year. In addition, a mechanism may be developed whereby it will be possible for 20 to 50 rockets to be launched from a plane by using a clip of rockets in an automatic repeater firing launcher. Today most planes carry only six rockets each and the plane must land to reload the rocket tubes before it can fire them again.

Rocket weapons on the ground will play an even more important role in warfare during 1945. Multiple rocket launchers mounted on trucks and jeeps from which many big rockets can be launched in salvo may see action. A hand rocket weapon, like a Very pistol used for shooting flares, may become a regular part of every soldier's equipment. These baby bazookas would be more effective than a rifle or carbine in many situations.

Big advances have been made in jet-propulsion this year, and the experience gained from the development and production of America's first jet-propelled airplane—the P-59 Airacomet, will undoubtedly prove of value in creating new, high-speed jet-propelled military planes that may see action before the year is out.

Gas turbine power plants for aircraft will probably be developed in 1945 to get away from the impracticably high fuel consumption of jet propulsion engines, and still get the high speed and altitude performance out of the airplane.

Shrink-Resistant Woolens

➤ THE TENDENCY of wool fiber to shrink and felt is due to its construction. Each tiny fiber is composed of a relatively hard outer surface with a soft core. When wet, these two portions of the wool fiber expand and contract in different degrees and work in opposite directions. This action is intensified in the presence of even the mildest soap and the gentlest of mechanical manipulation.

Recently our chemists discovered that a resin made from melamine could be utilized to minimize shrinkage. Ten years ago this remarkable chemical, which is produced from calcium cyanamide, was a laboratory curiosity. Today melamine is in large scale production and as a methylated formaldehyde condensate produes a water-soluble resin which gives unusual results in the control of wool shrinkage and felting. It is applied to the wool from a water solution. When the wool has taken up the required quantity, it is dried in the usual manner. This is followed by a quick high-temperature curing which polymerizes the resin into an insoluble form. The resulting fine distribution of the resin throughout the fibers stabilizes them without in any way detracting from the desirable qualities of the wool. The form of the fiber, which gives innumerable air spaces when woven into cloth and which in turn yields warmth, is kept intact. Absorbency, resiliency and smooth wooly feel are maintained and wearing qualities are unimpaired. The appearance of cloths so treated, even when viewed under high magnification, is unaltered!

The amount of shrinkage control which can be obtained varies, of course, with fabrics of different construction. In certain cases shrinkage has been reduced to as little as 2% even after the Government standard test of ten washings, ten minutes each, in hot water and soap, followed by two hot rinsings of five and one minutes, respectively, and drying each time. In another test a gray woolen shirting material, after treatment, showed a loss of only a little over 2% whereas when untreated it shrank over 30% after five launderings. The Government has used 800,000 yards of melamine-resin-treated wool for the lining of sleeping bags, and field tests indicate that it stands up well under the hard service.

The process is applicable not only to pure woolen fabrics but also to goods made up of mixtures of wool and spun rayon and, provided the percentage of cotton is not too high, for mixtures of wool and cotton.

While a substantial portion of the melamine resin is now being employed for the treatment of goods going to the armed services, there is enough of it being allocated for civilian purposes to provide yardage in reasonable volume and to take care of all requirements for practical plant trial runs.

—From *"For Instance,"*
(American Cyanimide Co.)

English, German and Russian, in the order named, are the three most important languages of chemistry according to a recent survey of chemical literature; over 40 per cent are in English; France held third place prior to 1940.

By Renewing Supplies of Free Carbon in Air

Volcanoes Assure Life On Earth

➤ GLOOMY EXPECTATIONS of a dead earth, with all life made impossible because all existing carbon has become locked up in vast beds of limestone and other unavailable compounds, will not be realized because volcanoes will continue to keep carbon in circulation, belching immense quantities of carbon dioxide into the atmosphere where plants can capture it and convert it into food for themselves and for plant-eating animals. So declares a New Zealand geologist, Prof. C. A. Cotton of Victoria University College, Wellington, N. Z., in the British journal Nature.

Prophecies of doom through world-wide carbon starvation are based on the assumption that the supply of "free" carbon in the atmosphere (mainly as carbon dioxide) was set up once for all in the world's geologic youth. Heavy permanent withdrawals by plants, as coal, and by animals, as limestone, chalk, etc., have greatly reduced the amount of available carbon, according to this theory. Burning of coal and oil returns only a fraction of the carbon to the atmosphere, for man uses only the cream of these combustible carbon deposits. Carbonaceous rocks must be considered permanently "frozen" carbon assets.

With most of this Prof. Cotton disagrees. He admits that the primitive atmosphere may have contained a considerably higher percentage of carbon dioxide than it now does; but with volcanic action constantly going on he does not see any prospect of our present supply being completely exhausted. The principal gases given off by volcanoes are water vapor and carbon dioxide. The water vapor of course condenses as rain; the carbon dioxide remains gaseous until captured as food material by plants or taken into solution by water.

Volcanic renewals of the earth's free carbon supply are not made at an even rate. The present seems to be a time of comparatively low volcanic activity. In fairly recent geologic time, however, there have been very vigorous volcanic outpourings, as for example when the tremendous lava fields of the northwestern United States were formed.

Prof. Cotton has undertaken to recalculate the total mass of the earth's primitive atmosphere. He arrives at a figure of 76,000,000,000,000,000 (76 quadrillion) metric tons. Of this 70,200,000,000,000,000 tons consisted of carbon dioxide alone, the remaining quantity being made up mainly of nitrogen and hydrogen. The nitrogen is still in the air; the hydrogen long ago combined with oxygen and became a part of the earth's water supply.

The English wool merchant in the Middle Ages, when visiting farms to purchase fleeces, carried two seven-pound weights bearthe Royal Arms; the farmer selected a stone to balance these on a scale and the "stone" became a unit of weight.

Jack-of-All-Trades Glycerine

► GLYCERINE, a chemical "jack-of-all-trades" used in literally thousands of products, is finding still new uses in medicines, paints, textiles, and food.

Glycerine, or glycerol as it is known chemically, is the chief vehicle for sulfa drugs to treat wounds, burns, and skin conditions, and lately has been used in penicillin-inoculated bandages, Georgia Leffingwell and Milton A. Lesser, New York chemists, point out in "Chemical and Engineering News," publication of the American Chemical Society.

Sterile glycerine is used for burns of the hands and face where formation of a tough film must be avoided, and this chemical also is employed in epinephrine (adrenalin) inhalant sprays for treating asthma.

Its physical properties make glycerine suitable as a moisture-absorbing agent, as a solvent, a suspending agent, a lubricant, an anti-freeze, a softener, a sweetener, a blending agent and other uses.

An alcohol, glycerine enters into many chemical combinations, and the most important of these products are the alkyd resins, indispensable in formulation of modern synthetic coating materials, ester gums, and nitroglycerin, the report said.

"Despite many new developments, the reaction products of glycerol and phtalic anhydride, suitably adjusted with a variety of modifying agents, still remain the basis of the alkyd type of synthetic resins," the report says.

These alkyds "have found extensive use in quick-drying, durable interior and exterior finishes, in automobile and refrigerator enamels and lacquers and, at present, in all types of protective coatings for the armed forces and adjunct agencies."

Among the new developments in prospect are use in water- and ice-repelling coatings, and in stimulating hammered metal finishes.

One type of this same kind of resin "has recently been advocated for treating cellulosic yarns and fabrics to render them heat-, acid-, and alkali-resistant," while in England "the use of a glyptal-treated rayon fabric has been sanctioned officially as a substitute for oiled silk, an essential in wound dressings."

The alkyds are being used increasingly in compositions for printing and dyeing of textiles, glycerine is a major raw material of the printing industry, and "the alkyd-type resins have been specified in an increasing number of patents for making photographic films, including color photography as well as in 'self-developable' photographic emulsions.

Millions of pounds of glycerine are used to plasticize cellophane to keep it from becoming brittle. Cellophane plasticized with glycerine has been recommended for protective clothing for workers since it is not affected by acids or petroleum solvents and guards the wearer against certain toxic gases.

Another expanding use of this versatile chemical is in electro-polishing methods, particularly in electro-polishing stainless steel.

A normal constituent of the body, glycerine is used by the ton in manufacture of base flavors for many food

products, including soft drinks. Foods can be quick-frozen in a glycerol medium.

Glycerine has been found to make baked goods stay fresh longer. Cake-baking experiments show that frozen whole eggs with 3 per cent glycerine give a smoother, finer, more even grain than either fresh or frozen eggs without glycerine.

Solar Still is Latest Among Three Methods

Fresh Drinking Water from the Sea

▶ MEN ADRIFT on a life raft now have three sources of fresh drinking water, thus bringing to a successful solution a situation which for centuries has posed a rough problem for men who battle the seas.

The most abundant source of drinking water is rainfall. Rain is caught in tarpaulins and transferred to an empty food tin or other receptacle for drinking.

However, the weather man cannot be counted upon to supply rain whenever men need a drink. Frequently men adrift on the sea are exposed to the hot, parching rays of the sun for days on end. Realizing this, Army Air Forces scientists set to work to find a way to use the sun's rays to take the salt out of sea water. The result was the solar still. Today, as long as the sun shines bright, and there's water in the sea, no castaways adrift need perish from thirst.

The solar still is a vinyl plastic envelope, 30 inches long with rounded ends 12 inches across. A plastic screen covered with black cellulose sponge is stretched through the middle. About 90 per cent of the sun's rays pass through the transparent "skin" of the envelope, which is inflated by blowing it up like a ballon. The sponge, soaked with two quarts of sea water, absorbs the heat. The heat evaporates the water, which passes off as vapor, just like steam from a teakettle, leaving only the sea salt and other minerals in the sponge. This vapor condenses as fresh water on the inside of the skin of the envelope and then runs down into a reservoir at the bottom of the still. The still is tied outside the raft and floats on the water, requiring little or no attention. On a sunny day the still will make about one pint of fresh drinking water. Six stills are packed aboard each life raft.

The third source is a chemical sea water desalting kit that comes packed in a neat can. It is designed for use when the sky is overcast, when there is neither rain nor sun. Heart of the chemical kit is a compound consisting of about two-thirds silver put up in briquettes in a package weighing about 22 ounces. One of these briquettes is dropped into a plastic bag filled with sea water. Almost instantly the briquette disintegrates and by precipitation removes the harmful salt and other substances. This kit produces eight times the amount of water contained in one drinking-water can.

The American Chemical Society

➤ THE AMERICAN CHEMICAL SOCIETY, organized 1876, and granted a federal charter 1938, now has almost 40,000 members, more than twice as many as any other organization of chemists in the world. Chemical knowledge and industry are fostered in all possible ways, the professional status of chemists and chemical engineers is promoted, and members are offered every opportunity to keep abreast of advancements in chemical science. Its steady growth and the rapid increase in circulation of its publications show the esteem in which it is held.

Full membership is open to any reputable person who has had adequate collegiate training in chemistry or chemical engineering, or its equivalent, and who has been actively engaged in some form of chemical work or graduate study for at least five years, except that only two years of experience will be required for graduates from institutions, the adequacy of whose courses has been accredited by the American Chemical Society. Junior membership is open to any reputable person adequately trained for or engaged in chemical work who cannot meet the requirements for full membership. Both are subject to election by the Membership Committee. There is no initiation fee. Students duly matriculated and majoring in chemistry or chemical engineering receive a discount of 33⅓ per cent from membership dues if they subscribe to one or more of the Society's three journals.

Membership and subscriptions begin with January 1 and continue until a member resigns or is dropped for nonpayment of dues. Those elected after October 1 may begin membership with the following January 1.

Membership dues of $7:50 (which includes the cost of a subscription to *Chemical and Engineering News*) must be paid annually in advance. Members in good standing are entitled to a single subscription to each of the Society's three journals at approximately 50 per cent discount from nonmember rates; all must be sent to one address. Charles L. Parsons is secretary and offices are at 1155 16th St., N.W., Washington 6, D. C.

Nylon Encases 1,000 Feet Per Minute

➤ A NEW NYLON compound coating on electric wires gives unusual protection because it is tough, resistant to abrasion and heat, and impervious to attack by practically all solvents. Ignited by a free flame, the nylon coating ceases to burn when the flame is removed, and is therefore self-extinguishing. The new coating is a development of E. I. du Pont de Nemours Company plastics department.

The coating is applied by an extruding process and wire can be coated at rates of over 1,000 feet per minute. It is laid snugly over the wire at an even thickness, which is determined by the wire speed as it passes through the plastic. The new compound may be found usable as a sealing material to fill the interstices between individual wires in a multi-strand cable.

New Formula Adds 25% Life To Shoe Wearing Qualities

Oil Improves Shoe Sole Leather

➤ SHOE SOLE LEATHER for soldiers and and civilians, treated with oil preparations to increase their wearing qualities, owe much of their improvement to a special oil formula developed at the laboratory of the Tanners' Council of America at the University of Cincinnati, and withheld from the public until recently. Dr. Fred O'Flaherty, director of the laboratory, the only one of its kind in the United States, announced the formula.

The sole leather should be immersed for 30 minutes in a solution of not less than 60% by weight of nonvolatile base, preferably solvent naphtha, not less than 25% by weight of a fatty oil with a viscosity of at least 2,500 Staybolt units at 100 degrees Fahrenheit, the balance of the oil base consisting of a mineral oil, preferably naphthenic-base oil, of such a viscosity that that the overall viscosity of the oil base, without solvent, exceeds 1,800 Staybolt units at 100 degrees Fahrenheit.

This oil treatment, Dr. Fred O'Flaherty, laboratory director, states, increases the wearability of shoe soles by 25% on an average.

The treatment of sole leather with oils, and with wax, is not altogether a new practice but the wartime scarcity of leather has caused its more extensive use and much interest has centered on a more satisfactory preparation than those formerly used.

During 1943 the National Bureau of Standards conducted extensive research on the improved wearing qualities of treated soles, examing some 30 commercial mixtures for waterproofing and improving the wear. The Bureau found the life of soles with preparations tested was increased from 14% to 40%, the higher percentages being with wax-impregnated leather. A Washington high school military unit was used by the Bureau in conducting its service tests.

Fresh Cider Throughout Year

➤ THE NATURAL taste of fresh cider will be available throughout the year in a new apple juice developed by the U. S. Department of Agriculture. The new product is a full-flavored apple juice concentrate which can be reconstituted, by the mere addition of water, to an apple juice which tastes and smells just like fresh apple cider.

It is made by heating fresh apple juice rapidly enough to avoid modifying its natural flavor, vaporizing the volatile flavoring constituents, and then collecting them as an essence from a simple fractionating column. The juice from which the flavoring constituents have been stripped is concentrated by evaporation and the flavoring essence added to the concentrated juice. This gives a full-flavored, self-preserving apple juice concentrate.

New Tests for Bronzes

➤ QUICK, easy, inexpensive and accurate is a new method, using an indicator solution recently developed to distinguish between manganese bronze and aluminum bronze in scrap and other metal. In the past this has been largely guesswork, because of the similarity in appearance of the two alloys. The discovery was made by the U. S. Bureau of Mines at its Pittsburgh experiment station.

To make the test, a small area of the metal is cleaned thoroughly of all dirt, scale and grease by grinding. This spot is then sprayed with a sulfuric acid solution. After the acid has had several seconds to react, a drop of the indicator solution is added. If the metal is manganese bronze a grayish-purple spot appears; but if it is aluminum bronze the spot is greenish-yellow.

The indicator solution consists of varied weights of ammonium-mercury thiocyanate, silver nitrate, and ammonium persulphate.

Research to Increase with War End

➤ CHEMICAL industries will start greatly increased research programs "to make up for lost time" just as soon as their war researches end, Dr. Elmer K. Bolton, chemical director of E. I. du Pont de Nemours & Co., predicted in accepting the Perkin Medal of the American section of the Society of Chemical Industry.

This postwar research to improve the American standard of living will be handicapped, however, he declared, by a serious shortage of well-trained chemists which will be felt for a number of years.

"Since World War I, the chemical industry has made remarkable progress," Dr. Bolton said, "due in a very important measure to the friendly attitude of the government toward research. Granted a continuation of this attitude, organized research will go on creating new products, for what remains to be done is far greater than anything that has been accomplished in the past."

Lubrication Engineers Form Society

➤ THE IMPORTANCE of proper lubrication in machines of all types, from tiny wrist watches to giant locomotives, and in gigantic war aircraft operating through desert dust and stratosphere cold, is now recognized to such an extent by technicians and chemists that a national organization has been formed with headquarters here. The new association is known as the American Society of Lubrication Engineers.

The objective of the association "is to put on a sound basis the fundamental precepts of lubrication," which it is believed will be of benefit to all phases of industry with their related problems. The society will also attempt to promote the training of lubrication engineers in engineering schools. C. E. Pritchard, Republic Steel Company, is president of the society, and B. H. Jennings, professor of mechanical engineering at Northwestern University, is secretary and treasurer.

Boil Water In Paper Cup

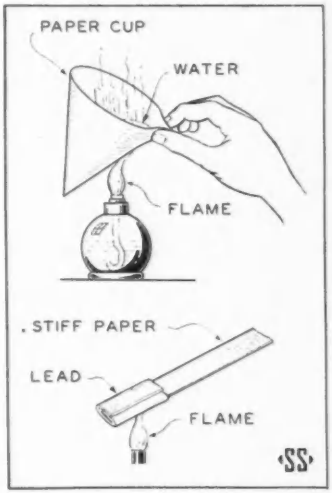
by JOSEPH H. KRAUS, *Science Clubs of America Editor*

➤ ALTHOUGH PAPER catches fire easily, it is possible to melt lead on a strip of paper and boil water in a paper cup. If you are careful, in neither case will the paper catch on fire.

Get the lead from a discarded cream or paste tube. You can tell the lead tubes by color and thickness of the metal; they are gray and heavier than tin tubes. With a pair of scissors cut off a strip about one and a half inches long. Slit the sections of tube and squeeze tightly around a fold of ordinary writing paper. If the lead extends slightly beyond the paper, there will be less likelihood of the paper catching fire. Hold the prepared paper over the flame of a bunsen burner, alcohol lamp, or even a wooden match. If the metal is directly above the flame, you can apply sufficient heat to melt the lead and yet not char the paper folded within.

It is also possible to place a lump of lead on a post card and melt the lead without setting fire to the post card. This is because the lead conducts heat away from the paper so fast that it never becomes hot enough to catch on fire. In practice, however, the paper often catches fire before the lead melts because the lead fails to remain in contact with the paper and therefore cannot conduct the heat away properly.

The ability of substances to conduct heat away to such an extent that a fire is not started is strikingly demonstrated by boiling water in a paper cup.



Fill an ordinary drinking cup, preferably a "hot cup," with water. Do not use the kind where the sides extend below the bottow and are not in contact with the water. Pinch the upper end between the thumb and forefinger and hold over the flame of an alcohol lamp or gas burner, as shown in the diagram.

Tip Cup Away From You

If you find the flame too hot for your fingers, tip the cup away from you and play the flame on the under surface. Soon the water will begin to

boil. If you keep the paper cup nearly full of water and always apply the flame beneath the water level, you will be able to boil water in this cup for hours at a time without setting the cup on fire.

Here again the same rule of physics applies. The water within the cup cannot reach a temperature of more than 212 degrees Fahrenheit or 100 degrees Centigrade under normal atmospheric conditions. The water conducts the heat of the flame away from the cup rapidly enough to prevent the paper from reaching a temperature higher than the boiling point of water. Even though the flame is much hotter, it cannot make the paper hot enough to ignite while the cup is nearly full of water.

Paints for Structural Steel

➤ ZINC CHROMATE and iron oxide-zinc chromate primings to protect iron and steel from corrosion, when properly formulated with a synthetic resin vehicle, make a very good rust-inhibitive coating, the National Bureau of Standards states in a new report on paints for structural steel.

They combine to a high degree the essential requirements necessary to withstand extremely severe corrosive atmospheres, the Bureau finds from extensive tests. Zinc-dust paints, particularly the alkyd type, have good adhesion on galzanized iron. Among the top-coat finishes tested, aluminum, black and dark-colored paints were found the most durable.

This report is the third and final summary of the Bureau's investigations of surface treatments for protecting steel against corrosion, with special reference to low-cost housing construction. Both outdoor and accelerated laboratory tests were used, and the primings were applied to treated and untreated steel and to galvanized iron panels.

Many paints were found suitable for use in protecting metal structures. Their composition and relative ratings, based on their performance in the tests, are discussed in the report, copies of which are now available from the Superintendent of Public Documents.

Uses for Lithium, Lightest Metal

➤ LITHIUM, LIGHTEST of all metals, weighing only one-fifth as much as aluminum, promises to have many postwar industrial applications. This silver-white metal, that occurs more plentifully in the earth than lead or tin, was little used before Pearl Harbor.

Today lithium and its compounds are used in high-conductivity copper castings, tin bronzes, silicon bronzes, aluminum welding, magnesium melting and casting, and in the heat-treating of metals. Removal of priority restrictions on lithium has opened the way to new uses, states Dr. Hans Osborg, vice president of Lithaloys Corporation, the country's largest producer of lithium metals and alloys.

Self-Sealing Gasoline Tanks For War Pioneer New Plastics

Postwar Autos More Decorative

➤ Plastic sandwiches developed during the war to take up the impact of bullets entering self-sealing fuel tanks has led to the development of heat- and weather-resistant laminated fabrics that will give new beauty to the interior decoration and exterior finish of your postwar automobile. These facts were brought out by Morris Sanders, industrial consultant and architect, at the recent meeting of the Society of Automotive Engineers.

The new laminates or plastic sandwiches, are made up with new contact resins, fiberglas, and fabrics. They can be functional or decorative, opaque or translucent, Mr. Sanders declared.

With this new process you can now choose decorative dress or drapery prints, use them in single or multiple laminate form, combine them with fiberglas, duck, or any other laminate. They can be formed into almost any shape you wish as long as the fabric itself is designed to permit such deformation.

If Mr. Sanders' predictions are accurate, it may mean that florists' delivery trucks will have flowery dress designs on the exterior side panels, station wagons will have plaid surfaces throughout, with designs taken from Scotch kilts, bus ceilings will be opaque by day but translucent when backlighted for night use. It will provide more freedom of action for the designer and engineer, more appeal to the buyer and his wife, he commented.

Synthetic textiles have been developed during the war for rough-tough performance rather than luxury, Mr. Sanders stated. As examples he pointed to nylon and Fortisan now serving as high-strength parachute materials, and at the same time they have beauty and are pleasant to feel.

Mr. Sanders pointed out that our new synthetics and semi-synthetics are color-receptive and at the same time soil-resistant and easily kept clean. We are no longer forced by necessity to choose colors that blend in with grease and grime. He predicts the soft glow of pastels and the flash of pure colors in automobile upholstery.

Additional Data on Chem Quiz

Who Was He? His Nationality was: A—English; B—German; C—French; D—Scotch; E—English; Bunsen—German. Write these facts in the spaces on page 19, and see whether you can now identify the scientists you couldn't place before. If nationality was necessary to tip you off, record your score as 15 for each guessed from this data. If you still have some unidentified, turn to page 38 for occupational clues.

Peat for fuel is dug in greatly increased amounts in Ireland to be used instead of coal formerly imported from England.

Chemical Patents Show Interesting Progress in Many Fields

Fewer Patents But Many Help War

by Dr. Frank Thone

➤ New patents issued by the U. S. Patent Office during 1944 averaged only a few more than 500 a week. This represents a new low, so far as recent years are concerned. Last year, which was considered a poor year for new inventions, saw an average output of 600 new patents a week; the pre-Pearl Harbor figure was around 800 a week.

This slump in numbers of new patents does not necessarily indicate a decrease in activity on the part of American inventors and scientists. They are harder at work than ever. However, whole groups of new devices and processes are not being patented at present, for security reasons. When a patent is granted a full description of it is published, which anyone can purchase by sending 10 cents in coin (not stamps) to the Commissioner of Patents, Washington, D. C. So new inventions of possible military value are simply being kept secret for the time being. This is especially the case with chemical inventions.

Another cause for the drop in number of patents issued is the practical wiping out of applications from inventors in continental Europe. In prewar days most such applications came from Germany, which is of course completely out for the duration. Applications from enemy countries and enemy-occupied territory, filed before the war, still mature into patents, which are of course promptly taken over by the Alien Property Custodian.

Many of the patents issed to Americans and to citizens of the United Nations have potential value in the war effort. Others obviously look forward to the great technological developments expected in the postwar world.

A few of the outstanding chemical or related inventions patented during 1944 are:

Synthetic production of toluene, base of TNT, from benzene and methane.

Ozone treatment of air circulated in refrigerated meat storage rooms, to prevent growth of molds.

A method of baking bread by internally heating the loaves with infrared radiation.

A solar heating system for houses, which can also be used for cooling the air in hot weather.

Dehydration of food products by exposure to intense fields of high-frequency waves.

Synthesis of motor fuels from carbon monoxide, hydrogen and other cheap gases.

A continuously-flowing process for sterilizing canned foods, to replace the batch process now in vogue.

A rotary kiln for extraction of mercury.

Chemical treatment for nylon tire cords, enabling rubber to get a better grip on them.

Magnesium-rolling process, avoiding flaking by lubrication with resin-like oils.

Synthetic production of alcohol from carbon monoxide and hydrogen.

A method for getting bits of scrap steel out of old slag-heaps, left there by earlier, inefficient smelting processes.

Absorbent, antiseptic cellulose powder as wound dressing.

Discardable external gasoline tanks for armored combat vehicles, to increase their fighting range.

A chemical method for converting dextrose into the much sweeter levulose.

Insecticides based on metallic double salts of nicotine, much less perishable than the nicotine compounds now in use.

A process for salvaging usable fatty acids for soap-making, out of ill-smelling waste greases and rancid oils.

Apparatus for injecting blood or plasma, in which air pressure is substituted for the customary gravity feed.

A process for de-salting sea water by treating it with basic silver oxide and uric acid.

A machine for ginning milkweed floss, now used instead of kapok in life belts.

A Freon-cooled three-horsepower electric motor that measures only 6.75 by 2 inches.

A process for extracting hitherto wasted glycerin from fermentation slops.

Lead-Free Bismuth

➤ RIDDING LEAD of bismuth that sometimes comes along with it from the ore is the problem tackled by Joseph C. Dittmer of St. Albans, N. Y. He removes the troublesome element by floating a flux of caustic soda on top of the molten lead, then introducing finely divided metallic sodium into the lead. The sodium combines with the bismuth to form a bismuthide, which dissolves in the flux and is thus removed from the lead. Rights in Mr. Dittmer's patent, No. 2,365,177, have been assigned to the National Lead Company.

Improvement in Butter Making

➤ MAKING BETTER BUTTER more quickly is the aim of the process covered by patent 2,365,217, granted to Charles A. Rogers of Detroit. Basically, it consists in the flash-pasteurization of sour cream by direct contact with live steam, before the churning process. This accomplishes two things: it breaks up the fat into small globules, and it reduces the cheesy protein to small fragments that can be separated out by means of a clarifying centrifuge. In its ordinary state, this protein forms a hard sludge that makes centrifuging impracticable.

Plastic Treatment for Dynamite

➤ TO MAKE a tougher dynamite, that will not become insensitive and refuse to explode when placed under high liquid pressure, as in a deep oil well, C. D. Bitting of Kenvil, N. J., and R. W. Lawrence of Wilmington, Del., treat with a urea-formaldehyde plastic the ground cork, balsa wood waste, cane bagasse or other inert carrier of the blasting gelatin. This, they state, gives the necessary added strength and stiffness to the cell walls to withstand the pressure. Rights in patent 2,365,170, issued on this invention, are assigned to the Hercules Powder Company.

Isolation of Gramicidin

➤ SIMPLIFICATION of the process for isolating gramicidin, a germ-checking substance similar to penicillin but produced by certain kinds of bacteria instead of a mold, is the basis for patent 2,365,499, obtained by Dr. Max Tishler of Merck and Company. Rights are assigned to the employing firm.

As carried on hitherto, gramicidin extraction had to be preceded by acid treatment of the mass bacterial cultures, to "loosen" the gramicidin from the proteins to which it seemed to be chemically bound. Dr. Tishler has found, however, that if the solid material is simply centrifuged out, then extracted with a neutral organic solvent like ethanol or acetone, a potent source of gramicidin can be obtained, ready for further purification in preparation for use.

Reclaimed Rubber Up-Graded

➤ RECLAIMED RUBBER can have its quality materially improved at moderate cost by a new depigmentizing process on which U. S. patent 2,365,662 was issued to Harry H. Thompson of Akron, Ohio.

One of the troublesome problems in reclaiming used rubber is the presence of carbon black and other pigments, intimately milled into it. In Mr. Thompson's process, the rubber is dissolved in benzol or other standard rubber solvent, with the addition of 20% by weight of bentonite, an exceedingly fine-grained claylike substance of remarkable adsorptive powers. The bentonite hangs onto the pigment, while the rubber departs in the solvent. The benzol can then be distilled off for re-use, leaving the rubber behind, or the solution can be used "as is" in preparing rubber cement or similar products. Rights in the patent have been assigned to the Wingfoot Corporation.

Goldenrod Rubber

➤ ANOTHER PATENT in the field of rubber chemistry is No. 2,365,950, granted to J. W. Haefele, Ridgewood, N. J., and Dr. John McGavack, Leonia, N. J., assignors to the United States Rubber Company.

One of the things that has prevented practical development of rubber production from native goldenrod, pioneered experimentally years ago by the late Thomas A. Edison, has been the tendency of the resins in the leaves to foam up excessively in the flotation process used for extracting the rubber. The two inventors eliminate this difficulty by adding sodium hydroxide or other alkali salt to the flotation medium. This dissolves the resins but not the rubber particles, which float up nicely and are easily removed.

Synthetic Chewing-gum Bases

➤ NATURAL CHICLE, basis for most chewing gums, may presently find itself in the ranks of the "technologically unemployed"—replaced by synthetic materials. Two types of such synthetic chewing-gum bases have been patented. One series, covered by patent 2,366,128, consists of fatty acids combined with maleic anhydride; the inventor, Dr. Frank B. Root of Montclair, N. J., has assigned his patent rights to the Ellis-Foster Company. The second series consists of hydrogenated resins like coumarone, styrene and pinene; its inventor, William H. Carmody of Springfield, Ohio, has received patent 2,366,086.

More Efficient Flour Bleaching

➤ A MACHINE for bleaching flour more efficiently is the subject of patent 2,365,767, obtained by Hugh McDonald of Minneapolis, assignor to the Pillsbury Flour Mills Company. In the apparatus commonly used nowadays, the inventor explains, part of the flour tends to form wads or lumps on the walls, resulting in over-bleaching. He prevents such lumping by jetting the flour into a cylindrical drum, where it is kept further stirred up by a fan at the bottom, while the bleaching gas is introduced through inlets at the top. No chance is given for lumps to form on the walls.

Producer for Oil Coke

➤ CONTINUOUS-PROCESS production of coke from heavy petroleum residues is covered by patent 2,366,057, granted to Dr. F. R. Russell, chemical engineer employed by the Standard Oil Development Company, to which patent rights are assigned.

In Dr. Russell's process, the oil, preheated to coking temperature, is introduced at the top of a conical tower and permitted to fall in a shower of small droplets through a counter-current of superheated steam. After passing through this hot zone, the drops fall through a cooled zone where the temperature is kept down by a cold water-jacket. By the time they reach the collecting hopper at the bottom, they have become small, solid globules of coke, very easy to handle, and without the usual troublesome tendency to cake up on the walls.

Iodo-Sugars for X-ray Work

➤ X-RAY EXAMINATIONS of the kidneys and associated organs will be facilitated by the use of a new group of chemical compounds, the iodo-sugars, on which patents 2,365,776 and 2,365,777 have been granted to Dr. A. L. Raymond, Northfield, Ill., and Dr. E. F. Schroeder, Chicago.

It has been found that X-ray photography of the kidneys is considerably facilitated if a considerable concentration of iodine is backed up in them. Drs. Raymond and Schroeder make this accumulation easier, and physiologically harmless, by injecting into the patient's vein a solution of a sugar (usually a hexose) which has had an iodine atom hooked onto one end of its molecular chain. Rights in their patent are assigned to their employing firm, G. D. Searle and Company, Skokie, Ill.

Keeping Vitamins in Beer

➤ SEEING THAT beer and ale retain their rightful stock of natural vitamins, generated by the yeasts that ferment them, is the object of the process put forward for patent 2,364,060 by M. W. Ditto and W. P. Torrington of New York City. In present beer-making processes, much of the natural vitamin content is taken out when the beverage is filtered, for the yeast cells go along with undesirable, turbidity-causing debris. In the new process, the green beer is first subjected to high pressure under carbon dioxide. Then the pressure is suddenly removed, causing the yeast cells to burst and release their vitamin contents into the liquid. The vitamins remain when the solid debris is filtered out. Rights in this patent are assigned to the Emulsions Process Corporation.

Daylight Lamp

➤ A NEW IDEA in daylight lamps is the basis for patent 2,364,707, granted to

W. H. Glover of Newark, N. J. Daylight lamps now in common use undertake to approximate natural sunlight as nearly as possible by the use of stationary color filters, together with adjusted mixtures of various gases within the lamps. Mr. Glover claims to have approached the real thing much more closely by interposing, between his lamps and the surfaces where the light is to be used, a motor-spun disk of transparent plastic bearing adjustable segments of the primary hues red, yellow and blue, permitting any desired "mix" of colors to be used that will convert the lamps' tinted light into pure white.

Photographic Light

➤ ANOTHER LAMP invention, designed especially for photographic printing and enlargement, is covered by patent 2,364,889, taken out by Lyman C. Blair of Houston, Texas. Concentrated light sources, giving uneven distribution of illumination, are handicaps in existing photographic equipment, Mr. Blair points out. He has therefore devised a flat, oblong mercury vapor lamp with several electrodes, giving a wide area of strong, even lighting.

Light Fastens Rivets

➤ STRONG LIGHT brought to a concentrated focus is used for fastening rivets in a unique device on which patent 2,364,730 has been granted to M. B. Leskin of Los Angeles, assignor to E. I. du Pont de Nemours & Company. Explosive rivets are widely used nowadays, especially in assembling airplanes; a small charge of powder set off by touching the head with a hot soldering-iron or similar tool, spreads the inner end without the necessity for a "bucker" in inaccessible small spaces. In the new device, a beam of light, focussed to a sharp point by a lens, is substituted for the hot metal. Quicker results and safer manipulation by inexperienced workers are among the advantages claimed.

Mercury for Bearings

➤ ANYBODY who has ever fooled around with mercury will admit that it is just about the slipperiest of substances. Franz R. Hensel of Indianapolis takes advantage of this property of quicksilver in a new type of self-lubricating bearing, on which he has received patent 2,364,713. He shapes the bearing out of a metal with which mercury does not form an amalgam, such as iron, nickel or cobalt, using metal powder and sintering it. The porous form thus produced is then impregnated with the mercury.

Occupational Clues on Chem Quiz

Who Was He? His Occupation was: A—Metallurgist; B—Selling Nostrums; C—Professor of Chemistry; D—Mineralogist; E—Physician and chemist; Bunsen—Professor of Chemistry.

Add these facts to the outline on page 19, and for each new name correctly guessed count 10 on your score. If you still need help, the clues on page 46 should be the give-away.

In 1909, Germany published 45 per cent of the world's chemical research literature; under Hitler it dropped in 1939 to less than 19 per cent.

Classics of Chemistry:
The Noble Metals of Group I.

Copper, Silver and Gold

EXCELLENCE of a purely mystical quality shimmers over the legendary associations mankind links with the metals he has always called precious.

Gold means not mere wealth, but rare, effulgent beauty beyond good and evil. Silver is pure cold radiance, like moonlight. Copper was sacred to mysterious elder deities, long-forgotten even when the world was young.

Hesiod's little parable of the Golden Age introduces Group I b as it appeared to the Greeks.

Alchemy, the fabled art of Hermes Trismegistus in Egypt, began as a collection of recipes. It made the naive assumption that anything with a metallic sheen is a metal and all metals are one.

Later, Adepts of the Sacred Art became more interested in profits than in metallurgy. Then, as Berthelot observes, after ballyhooing transmutation for so long, they finally came to believe in it themselves.

Perhaps the frauds of the later alchemists gave a bad name to all metal work. Perhaps schemes to sell mining stock in the Middle Ages were not unlike some practices in our own Wild West. Perhaps Agricola just happened to know many people who thought that whatever is, is wrong. At any rate, the great authority on mining crafts felt it necessary to argue that digging up metals is not unrighteous.

"He either fears his fate too much,
Or his deserts are small,
That dares not put it to the touch
To gain or lose it all."

The touchstone is more than a figure of speech. It is the mineralogist's streak-plate, carried to a quantitative degree of perfection. Agricola explains its use.

These quotations cover some of the literary allusions which are part of the story of the noble metals. The metallurgy of these ancient chemicals will be the subject of a later Classic of Chemistry.

The Golden Age

HESIOD: WORKS AND DAYS, English translation by Hugh G. Evelyn-White, in The Loeb Classical Library. London: Heineman, 1914.

IF YOU WILL, I will sum you up another tale well and skilfully—and do you lay it up in your heart—how the gods and mortal men sprang from one source.

First of all the deathless gods who dwell on Olympus made a golden race of mortal men who lived in the time of Cronos when he was reigning in heaven. And they lived like gods without sorrow of heart, remote and free from toil and grief: miserable age rested not on them; but with legs and arms never failing they made merry with feasting beyond the reach of all evils. When they died, it was as

though they were overcome with sleep, and they had all good things; for the fruitful earth unforced bare them fruit abundantly and without stint. They dwelt in ease and peace upon their lands with many good things, rich in flocks and loved by the blessed gods.

But after the earth had covered this generation—they are called pure spirits dwelling on the earth, and are kindly, delivering from harm, and guardians of mortal men; for they roam everywhere over the earth, clothed in mist and keep watch on judgments and cruel deeds, givers of wealth; for this royal right also they received;—then they who dwell on Olympus made a second generation which was of silver and less noble by far. It was like the golden race neither in body nor in spirit. A child was brought up at his good mother's side an hundred years, an utter simpleton, playing childishly in his own home. But when they were full grown and were come to the full measure of their prime, they lived only a little time and that in sorrow because of their foolishness, for they could not keep from sinning and from wronging one another, nor would they serve the immortals, nor sacrifice on the holy altars of the blessed ones as it is right for men to do wherever they dwell. Then Zeus the son of Cronos was angry and put them away, because they would not give honor to the blessed gods who live on Olympus.

But when earth had covered this generation also—they are called blessed spirits of the underworld by men, and, though they are of second order, yet honor attends them also—Zeus the Father made a third generation of mortal men, a brazen race, sprung from ash-trees; and it was in no way equal to the silver age, but was terrible and strong. They loved the lamentable works of Ares and deeds of violence; they ate no bread, but were hard of heart like adamant, fearful men. Great was their strength and unconquerable the arms which grew from their shoulders on their strong limbs. Their armour was of bronze, and their houses of bronze, and of bronze were their implements; there was no black iron. These were destroyed by their own hands and passed to the dank house of chill Hades, and left no name: terrible though they were, black Death seized them, and they left the bright light of the sun.

But when earth had covered this generation also, Zeus the son of Cronos made yet another, the fourth, upon the fruitful earth, which was nobler and more righteous, a god-like race of hero-men who are called demi-gods, the race before our own, throughout the boundless earth. Grim war and dread battle destroyed a part of them, some in the land of Cadmus at seven-gated Thebe when they fought for the flocks of Oedipus, and some, when it had brought them in ships over the great sea gulf to Troy for rich-haired Helen's sake: there death's end enshrouded a part of them. But to the others father Zeus the son of Cronos gave a living and an abode apart from men, and made them dwell at the ends of the earth. And they live untouched by sorrow in the islands of the blessed along the shore of deep swirling Ocean, happy heroes for whom the grain-giving earth bears honey-sweet fruit flourishing thrice a year, far from the deathless gods, and Cronos rules over them; for the father of men

and gods released him from his bonds. And these last equally have honor and glory.

And again far-seeing Zeus made yet another generation, the fifth, of men who are upon the bounteous earth.

Thereafter, would that I were not among the men of the fifth generation, but either had died before or been born afterwards. For now truly is a race of iron, and men never rest from labour and sorrow by day, and from perishing by night; and the gods shall lay sore trouble upon them. But, notwithstanding, even these shall have some good mingled with their evils.

Alchemy

COLLECTION DES ANCIENS ALCHIMISTES GRECS, publiée sous les auspices du ministère de l'instruction publique, par M. Berthelot, Sénateur, Membre de l'Institut, Professeur au Collège de France, avec la collaboration de M. Ch.-Em. Ruelle, Bibliothécaire a la Bibliothéque Sainte-Geneviève, Paris, Georges Steinheil, Éditeur, 1887. Translated for CHEMISTRY by Helen M. Davis.

➤ Instead of coloring metals on the surface, to give them the appearance of gold or silver, Egyptian goldsmiths early learned to color them throughout, that is to say, to change them in nature. The processes employed by them consisted of making alloys of gold and of silver conserving the appearance of the metal. This is what they called *diplosis*, the art of "doubleing" the weight of gold and silver, an expression which was handed down to the alchemists along with the pretense of thus obtaining the metals, not simply mixed, but completely transformed.

The word "to double" actually belongs to the same class of ideas, but has come down to us with a very different meaning, until today it signifies two superposed metallic layers. To the alchemists it had a much wider meaning.

In fact the word *"diplosis"* then implied sometimes simply increasing the weight of a precious metal by adding a metal of less value which did not change its appearance, sometimes making the piece of metal wholly gold or silver by transmuting the nature of the added metal. All metals are basically the same, according to the theories of the Platonists about primary matter. Even the silver of the transformation is a part of the original alloy, playing the rôle of ferment.

All these procedures are as clear and positive, except for uncertainty about the meaning of some words, as our own recipes. It is all the more surprising, therefore, to see appear, in the midst of so precise a technical procedure, the chimera of true transmutation, correlated as it is with the intention of falsifying the metals. The falsifier, after repeatedly deceiving the public, must at length have ended by believing in the actuality of his work. He would come to believe, as much as his dupe, in that which he had at first proposed to do. Therefore the relationship of these recipes with those of the alchemists is thus, perhaps, completely established.

I have already shown the identity of some recipes for gilding, in this papyrus, with the recipes for transmu-

tation of Pseudo-Democritus. I shall follow this demonstration through presently in speaking of *asem*. It is strikingly like the *diplosis* of Moses, a recipe as short and clear as that of the papyrus of Leiden and probably taken from the same sources, at least if we may judge by the rôle of Moses in this papyrus itself. The procedure of Moses, explained in a few lines, is as follows:—

"Take some copper, some arsenic (orpiment), some sulfur and some lead; grind the mixture with oil of horseradish; roast it upon charcoal to desulfurize it; set it aside. Take 1 part of this roasted copper and 3 parts of gold; put it into a crucible; heat; and you will find all changed into gold, with the help of God."

This is an alloy of debased gold, analogous to those described above.

The solders for silver used by goldsmiths of our day are also made with compounds of arsenic. We read, for example, in the *Roret Manual*, Vol. II, p. 186 (1832):—

"Three parts silver, 1 part brass: fuse; add a little powdered orpiment.

"Or: fine silver, 1 oz.; brass shavings, 1 oz.; arsenic, 1 oz. Melt first the silver and the brass and then add the arsenic.

"Or: silver, 4 oz.; brass, 3 oz.; arsenic, 2 gros. [*An old weight: 1 gros = 59 grains—Ed.*]

"Or: silver, 2 oz.; tinsel, 1 oz.; arsenic, 4 gros; melt one after the other; a good solder."

It may be noted that the statement of these formulas in our day takes a form similar to that of the formulas of the papyrus and of the manuscripts. It is especially like modern recipes for preparing *white tombac* or white copper, and English imitation silver.

In every case in the papyrus the copper is colored by means of arsenic, as among the alchemists, always with the avowed intention of falsification.

The formula of Eugenius, which follows in the Venetian manuscripts, is a little more complicated than that of Moses. It also relies upon the use of roasted copper, mixed with gold and melted, to which orpiment is added. This mixture, treated with vinegar, is exposed to the sun for two days; then it is dried; it is added to silver, which makes it like electrum; the whole is then added to gold, in equal parts. This completes the operation. This is again the same kind of alloy, which the author pretends to identify finally with pure gold.

Justification of Mining

DE RE METALLICA by Georgius Agricola, Book I. Translated from the First Latin Edition of 1556 with biographical introduction, annotations and appendices upon the development of mining methods, metallurgical processes, geology, mineralogy and mining law from the earliest times to the 16th century, by Herbert Clark Hoover and Lou Henry Hoover. Published for the Translators by The Mining Magazine, Salisbury House, London, E.C. 1912.

➤ IN THE FIRST place, then, those who speak ill of the metals and refuse to make use of them, do not see that they accuse and condemn as wicked the Creator Himself, when they assert

that He fashioned some things vainly and without good cause, and thus they regard Him as the Author of evils, which opinion is certainly not worthy of pious and sensible men.

In the next place, the earth does not conceal metals in her depths because she does not wish that men should dig them out, but because provident and sagacious Nature has appointed for each thing its place. She generates them in the veins, stringers, and seams in the rocks, as though in special vessels and receptacles for such material. The metals cannot be produced in the other elements because the materials for their formation are wanting. For if they were generated in the air, a thing that rarely happens, they could not find a firm resting-place, but by their own force and weight would settle down on to the ground. Seeing then that metals have their proper abiding place in the bowels of the earth, who does not see that these men do not reach their conclusions by good logic? . . .

Now let us reply to the attacks hurled against the products of mines. In the first place, they call gold and silver the scourge of mankind because they are the cause of destruction and ruin to their possessors. But in this manner, might not anything that we possess be called a scourge to human kind—whether it be a horse, or a garment, or anything else? For, whether one rides a splendid horse or journeys well clad, he would give occasion to a robber to kill him. Are we then not to ride on horses, but to journey on foot, because a robber has once committed a murder in order that he may steal a horse? Or are we not to possess clothing, because a vagabond with a sword has taken a traveller's life that he may rob him of his garment? The possession of gold and silver is similar. Seeing then that men cannot conveniently do all these things, we should be on our guard against robbers, and because we cannot always protect ourselves from their hands, it is the special duty of the magistrate to seize wicked and villainous men for torture, and, if need be, for execution.

Again, the products of the mines are not themselves the cause of war. Thus, for example, when a tyrant, inflamed with passion for a woman of great beauty, makes war on the inhabitants of her city, the fault lies in the unbridled lust of the tyrant and not in the beauty of the woman. Likewise, when another man, blinded by a passion for gold and silver, makes war upon a wealthy people, we ought not to blame the metals but transfer all blame to avarice. For frenzied deeds and disgraceful actions, which are wont to weaken and dishonour natural and civil laws, originate from our own vices. . . .

When ingenious and clever men considered carefully the system of barter, which ignorant men of old employed and which even today is used by certain uncivilized and barbarous races, it appeared to them so troublesome and laborious that they invented money. Indeed, nothing more useful could have been devised, because a small amount of gold and silver is of as great value as things cumbrous and heavy; and so peoples far distant from one another can, by the use of money, trade very easily in those things which civilised life can scarcely do without.

The Touchstone

DE RE METALLICA by Georgius Agricola, Book VII., as above.

➤ IT REMAINS to speak of the touchstone with which gold and silver are tested, and which was also used by the Ancients. For although the assay made by fire is more certain, still, since we often have no furnace, nor muffle, nor crucibles, or some delay must be occasioned in using them, we can always rub gold or silver on the touchstone, which we can have in readiness. Further, when gold coins are assayed in the fire, of what use are they afterward? A touchstone must be selected which is thoroughly black and free of sulphur, for the blacker it is and the more devoid of sulphur, the better it generally is; I have written elsewhere of its nature. First the gold is rubbed on the touchstone, whether it contains silver or whether it is obtained from the mines or from the smelting; silver also is rubbed in the same way. Then one of the needles that we judge by its color to be of similar composition, is rubbed on the touchstone; if this proves too pale, another needle which has a stronger colour is rubbed on the touchstone; and if this proves too deep in colour, a third which has a little paler colour is used. For this will show us how great a proportion of silver or copper, or silver and copper together, is in the gold, or else how great a proportion of copper is in silver.

These needles are of four kinds. The first kind are made of gold and silver, the second of gold and copper, the third of gold, silver, and copper, and the fourth of silver and copper. The first three kinds of needles are used principally for testing gold, and the fourth for silver. Needles of this kind are prepared in the following ways. The lesser weights correspond proportionately to the larger weights, and both of them are used, not only by mining people, but by coiners also. The needles are made in accordance with the lesser weights, and each set corresponds to a *bes*, which, in our own vocabulary, is called a *mark*. The *bes*, which is employed by those who coin gold, is divided into twenty-four double *sextulae*, which are now called after the Greek name *ceratia;* and each double *sextula* is divided into three units of four *semi-sextulae*, which are called *granas;* and each *semi-sextula* is divided into three units of four *siliquae* each, of which each unit is called a *grenlin*. If we made the needles to be each four *siliquae*, there would be two hundred and eighty-eight in a *bes*, but if each were made to be a *semi-sextula* or a double *scripula*, then there would be ninety-six in a *bes*. By these two methods too many needles would be made, and the majority of them, by reason of the small difference in the proportion of the gold, would indicate nothing, therefore it is advisable to make them each of a double *sextula;* in this way twenty-four needles are made, of which the first is made of twenty-three *duellae* of silver and one of gold. Fannius is our authority that the Ancients called the double *sextula* a *duella*. When a bar of silver is rubbed on the touchstone and colours it just as this needle does, it contains one *duella* of gold. In this manner we determine by the other needles what proportion of gold there is, or when the

gold exceeds the silver in weight, what proportion of silver.

The needles are made: the first needle of 23 *duellae* of silver and 1 *duella* of gold, the second needle of 22 *duellae* of silver and 2 *duellae* of gold, . . . the 24th needle of pure gold.

By the first eleven needles, when they are rubbed on the touchstone, we test what proportion of gold a bar of silver contains, and with the remaining thirteen we test what propotion of silver is in a bar of gold; and also what proportion of either may be in money.

Since some gold coins are composed of gold and copper, thirteen needles of another kind are made as follows: the first of 12 *duellae* of gold and 12 *duellae* of copper, the second of 13 *duellae* of gold and 11 *duellae* of copper, . . . the 13th of pure gold.

These needles are not much used, because gold coins of that kind are somewhat rare; the ones chiefly used are those in which there is much copper. Needles of the third kind, which are composed of gold, silver, and copper, are more largely used, because such gold coins are common. But since with the gold there are mixed equal or unequal portions of silver and copper, two sorts of needles are made. If the proportion of silver and copper is equal, the needles are as follows: the first of 12 *duellae* of gold, 6 *duellae* of silver, 6 *duellae* of copper; the second of 13 *duellae* of gold, 5 *duellae* 1 *sextula* of silver, 5 *duellae* 1 *sextula* of copper; the third of 14 *duellae* of gold, 5 *duellae* of silver, 5 *duellae* of copper; . . . the 13th of pure gold.

Some make twenty-five needles, in order to be able to detect the two *scripula* of silver or copper which are in a *bes* of gold. Of these needles, the first is composed of twelve *duellae* of gold and six of silver, and the same number of copper. The second, of twelve *duellae* and one *sextula* of gold, and five *duellae* and one and a half *sextulae* of silver, and the same number of *duellae* and one and a half *sextulae* of copper. The remaining needles are made in the same proportion.

Pliny is our authority that the Romans could tell to within one *scripulum* how much gold was in any given alloy, and how much silver or copper.

Needles may be made in either of two ways, namely, in the ways of which I have spoken, and in the ways of which I am about to speak. . . .

[*Lists of the proportions in which needles are made to test the three metals in unequal proportions, and to test combinations of silver and copper follow—Ed.*]

So much for this. Perhaps I have used more words than those most highly skilled in the art may require, but it is necessary for the understanding of these matters.

At least one manufacturer of wood preservatives maintains a culture laboratory where, under sterile conditions, fungi and other wood-destroying organisms are used to test the efficiency of the various toxic chemicals.

Tin production at the government's smelter in Texas is at the rate of 30,000 long tons a year; American consumption of tin in all forms exceeds 80,000 tons annually.

Who's Who in this Month's Classic

HESIOD (8th Century B.C. ?) is famous as the author of the first "Farmer's Almanac" of the Greeks, "Works and Days." We quote a famous passage illustrating the relative rank of the metals in popular esteem. The poem gives advice about the proper seasons and lucky days for planting and harvesting, and some pointers on etiquette which picture life among the ancient Greeks very vividly. Hesiod, from his own testimony, was living in an Age of Iron, while the poems of Homer are remarkable for making no mention of that metal.

GEORG BAUER (1490-1555 A.D.), who, writing in Latin, translated his name to AGRICOLA, was one of the few educated men of all time to interest himself in how the work of the world is done. We shall have occasion to quote him further in connection with metallic elements, and reserve until that time the story of "De Re Metallica" and its translation by Herbert Clark Hoover and Lou Henry Hoover.

MARCELLIN PIERRE EUGENE BERTHELOT (1827-1907) was a French chemist who was active in the service of his country. He worked on explosives during the Franco-Prussian War, served in the Department of Education, was elected Senator for life, and succeeded Louis Pasteur as perpetual secretary of the Academy of Sciences. For recreation he translated ancient papyri and manuscripts on alchemy which had been brought by archaeological explorers to Europe from Egypt and the East.

New Chemical For Acute Asthma

➤ A NEW CHEMICAL, said to be better for acute asthmatic attacks than epinephrine, or adrenalin as it is also known, is reported by Dr. M. L. Tainter, of the Winthrop Chemical Company, and Dr. W. M. Cameron, Dr. L. J. Whitsell and Dr. M. M. Hartman, of Stanford University School of Medicine, in the Journal of Pharmacology and Experimental Therapeutics.

Ethylnorsuprarenin is the name of the new chemical. It is a colorless, odorless, crystalline powder with a bitter taste, chemically described as 1-(3,4-dihydroxyphenyl)-2-amino-1-butanol. It may be injected under the skin, into the muscles or into the veins. It takes effect in from one to five minutes, the effect lasting from 20 minutes to one hour. Fewer reactions such as pain over the heart, nausea, vomiting and nervousness were observed in the same patients when this drug's effect was compared with that of epinephrine.

Chem Quiz—He Was Famous For:

A—Anti-friction bearings; B—Preparing inorganic chemicals; C—A method of organic synthesis; D—Work with polarized light; E—Theory of constitution of the elements; Bunsen—Study of heat and flame. For those identified by these final clues, give yourself 5 each. Now turn to page 53 to see whether you are right.

"Grin and Bear It" cartoon by Lichty—Chicago Times Syndicate

"Our simple life must be very boring to you Americans with your vitamins, television, penicillin, radar and such."

Third in a Series on Presenting an Introduction to Chemistry

Elements and Their Atoms

by HELEN M. DAVIS

THIRD *in a series of articles that take the reader along the pathways of basic chemistry, by easy stages.*

➤ IN THE EIGHTEEN-SIXTIES chemists might have said, as Robert Louis Stevenson did twenty years later, that "the world is so full of a number of things." They had more elements than they knew what to do with, and new ones were continually being discovered.

Some elements are so much alike in their behavior that they naturally group themselves into families, but there seemed to be no clanship to unite the families. Lots of people puzzled over the problem of finding some underlying law in explanation of all this diversity.

Prout in 1815 had suggested that, since most atomic weights are almost whole numbers, perhaps the heavier elements are built up by combinations of hydrogen. He had no real evidence to base his hypothesis upon, but his idea has seldom been out of chemists' minds since.

In 1829 Döbereiner had grouped many of the elements into triads, the atomic weight of whose middle member is the mean of the atomic weights of the lighter and the heavier members. Chlorine, bromine and iodine formed a typical triad. Fluorine, although known, was disregarded. Sulfur, selenium and tellurium formed another triad. But, however the elements were grouped, there were always some left over.

For the next thirty years, chemists made lists of the habits of elements. Two men succeeded in getting them into a logical pattern. Lothar Meyer, in Germany, made a diagram by plotting atomic weight against "atomic volume" (density divided by atomic weight). It brough out very clearly a periodic variation in the elements, and showed similar elements occupying similar positions on the curve.

Dmitri Mendeleeff, in Russia, drew up a table which grouped the related elements. He made the daring prediction that unknown elements would one day be discovered to fill the gaps that his arrangement disclosed in the list.

After Mendeleeff's prophecies had been fulfilled, chemists put together the best features of his and Meyer's arrangements to give the Periodic Table as we know it.

Isotopes

It was a matter of faith to 19th century chemists that the atomic weight is the one absolute and unchanging property of an element. Analytical methods of the utmost delicacy were developed to determine

combining weights as accurately as possible, and international committees were set up to evaluate the work done and decide just which fraction would be considered the official one. They still function, but the center of attention has shifted.

The 19th century was very smug in its belief that the pinnacle of knowledge had been reached. Then, just at the end of the century, the discoveries of X-rays, radium and the inert gases pierced the fog beyond and revealed greater and more mysterious peaks still to be scaled.

One of the first sure foot-holds to be lost was the idea of the absolute nature of the elements. In the case of radium, the chemist is a passive spectator at the drama of transmutation. The alchemist's dream has come true, but the Philosopher's Stone, which was to bring it about, turns out to be just another delusion of the human mind. All the time the alchemists were experimenting, learning many useful techniques on the side, uranium was quietly turning into radium and radium into radon and so on to lead.

The lead which, since the beginning of the word, has been accumulating in radio-active ores is just like lead from any other kind of ore *except in its most important characteristic.* Its atomic weight is different. To the old-fashioned chemist, that would have been heresy. But the great virtue of science is that it does not postulate infallibility. The chemist can change his mind whenever the evidence warrants it.

As soon as chemical theory was freed from the idea that there is one absolute atomic weight for each element, the puzzle of the fractional weights began to disappear. It now looks as though all elements as we know them are mixtures of isotopic forms, alike in chemical properties but different in weight. The individual weights turn out to be whole numbers. The fractions result from mixtures of the isotopes in unequal proportions, and represent an average.

Heavy Hydrogen

The theory of isotopes was worked out by Soddy from the radio-active elements, but it was not long before isotopes of nearly all the elements were found. Urey of Columbia University, New York City, working with Brickwidde of the U. S. Bureau of Standards, Washington, D. C., in the fall of 1931 found the first isotope of hydrogen. Its atomic weight is 2.

When the weight of one isotope of lead is 206 and the other 207, the net difference is not very great. But the new form of hydrogen has an atomic weight 100 per cent greater than the old, and it was felt that that might make a difference in its properties. Its compound with oxygen, called "heavy water" was investigated with great curiosity. But, although some of its properties show some peculiarities, heavy hydrogen is on the whole much like the lighter form. A third, radio-active kind of hydrogen, of atomic weight 3, was reported in 1934 by Lord Rutherford.

Ammonia gas is used as the "controlled atmosphere" for annealing electronic tubes, heating coils, electric heaters and electric irons.

Dual Role of Helium

Elements of atomic weight, 1, 2 and 3 are all hydrogen. That of weight 4 is a different sort of element. It is helium, first of the rare gases. Instead of the chemical activity of hydrogen which enters into many combinations, sometimes with violence, helium shows the passivity of all the Group 0 elements. It enters into no combinations and has no chemical properties. But helium figures in a different kind of chemical phenomenon, in many ways the strangest in all science.

When radio-active elements disintegrate they are seen to glow with a soft but penetrating luminescence. This can be separated into three kinds of rays by interposing screens of various materials, by passing them through a magnetic field, by refracting them through crystals and by making them affect photographic plates. The three kinds of rays given off by radio-active material are called *alpha, beta* and *gamma* rays.

Gamma rays are wave motion, like light. They are similar to X-rays, which are given off when an electric spark is passed through a tube exhausted of most of its air. *Gamma* rays are of somewhat shorter wave length than X-rays, but are the same sort of phenomenon.

Beta rays are not waves. They are streams of infinitely small but discrete particles which seem to be not matter but electricity. They are bare, disembodied electrons.

It was not too startling to find atoms of radio-active matter vibrating to send out ultra-short light waves, or throwing off streams of electrons, but the *alpha* rays were really a surprise. They are the hearts of helium atoms, carrying two positive electric charges apiece.

Here is one chemical element throwing off rays which turn out to be another chemical element of an extremely different kind. Radium, uranium, thorium and actinium all throw off helium. And after they have lost the helium they have each turned into a still different element, whose atomic weight is less than the original by the weight of the helium atom lost.

The helium was not in combination with radium. The makings of helium were in the radium atom. The radium atom broke up, and helium and radon emerged from the wreck.

These radio-active changes are the basis of the new science of atomic physics. Mathematicians are busy at the present time trying to reduce to consistent formulae the strange and contradictory behavior of these minute particles and their attendant manifestations of motion and energy.

Theory of the Elements

As far as we can deduce at the present time, the design of the solar system furnishes a fairly good model for the structure of the atom. There is a large, heavy nucleus at the center. Around it revolve planetary electrons in their particular orbits. Unlike the planets in the solar system where we live, electrons seem to have the habit of jumping from one orbit to another, but doubtless this happens infrequently to any individual atom.

The outermost electrons in the atom system seem to be responsible for the chemical valences of the elements. An atom that has lost one or two electrons is a chemical ion with a positive valence migrating about in search of a partner with an electron to spare. An atom with an excess of electrons is a negative ion.

The most stable compounds are those whose electron rings have the most stable configurations. Elements which have two atoms to the molecule are thought to share their outer electrons, making a more stable pattern than one atom would have alone. They are said to be co-valent. Elements of different sorts in compounds supply each other's needs in numbers of outer ring electrons. The term for them is di-valent.

Nucleus and Electrons

The nucleus is the part of the atom that accounts for the atomic weight. By various indirect methods, whose results can be used to check each other, measurements have been obtained which give the masses and dimensions of atoms and their attendant phenomena. A set of these physical constants, the foundation of a fascinating branch of modern mathematics, was published by the U. S. Bureau of Standards in 1939.

The mass of the electron, according to these figures is: $m_e = 9.103 \pm 8 \times 10^{-28}$ gram. The mass of an atom of unit atomic weight is $m_1 = 1.6594 \pm 14 \times 10^{-24}$ gram if the chemist's unit of O = 16 is used. Physical measurements now being investigated demand a finer degree of accuracy, so the physicists call oxygen's most abundant isotope O = 16 and recalculate the value of m_1 to equal $1.6589 \pm 14 \times 10^{-24}$ gram.

Without going further into atomic calculations, it is evident that m_e, the mass of the electron, being only about 1/1000 as great as that of m_1, is practically negligible compared to that of the atom. It is assumed that m_1 is the weight of one atom of ordinary hydrogen, and it is further assumed that the atom of hydrogen consists of a unit nucleus and a lone electron spinning around it. This is the physicist's favorite atom, for it is so simple.

The electron has practically but one attribute, its negative electric charge. Therefore there is postulated for the nucleus of the atom a positive charge to hold the electron in its orbit. So we have, for the hydrogen atom, a heavy nucleus, whose weight is unity in the chemist's scale, attended by one electron. When the electron strays, the unsatisfied attraction of the positive nucleus accounts for hydrogen's single valence.

How does the picture change to account for hydrogen's isotope, deuterium? The atomic weight changes to 2, the valence does not change. The mass of the nucleus is doubled, the single planetary electron is present. The net electrical behavior is unchanged. To meet this evidence, the physicist postulates the "neutron" which is like the proton of the nucleus in weight but electrically neutral. Deuterium, therefore, is made up of a proton and a neutron in the nucleus, and one electron.

Tritium, the third isotope of hydrogen, would, according to the same scheme, be composed of one proton and two neutrons in the nucleus, and one electron. Instability of such a nucleus would account for its radio-active property.

Hydrogen, however, is not the only element of atomic weight 3. An isotope of helium has also been found of that weight. The atomic theory accounts for the difference in chemical properties by supposing the nucleus of the helium isotope to contain two protons and one neutron.

The number of protons in the nucleus is considered to be always the same as the atomic number of the element. Each proton can hold one electron, so the orbits of the helium atom have two satelite electrons. Helium thrown off from radio-active elements as *alpha* rays appears to be lacking these two electrons.

The usual form of helium, of atomic weight 4, would have two protons and two neutrons in the nucleus, and two electrons. The symmetrical arrangement possible in an atom of this constitution is believed to account for helium's inert chemical behavior.

Going on now to the next element, lithium, the number of protons would be 3 to correspond to the atomic number, and they would hold 3 electrons. But one of these electrons should be more easily lost than the other two, because lithium exhibits a valence of one. To account for this fact, the atom-builder believes that a two-electron system is better balanced than a three, and places two electrons in an inner ring, one in an outer. The atomic weight of lithium is classically 6.94, resulting from isotopes weighing 6 and 7. To form them, he must add 3 and 4 neutrons respectively to the three-proton nucleus.

Element 4, beryllium, in Group II, would work out as composed of 4 protons, for the number, plus 5 neutrons, to make up the atomic weight 9, and 4 electrons, two stable (inner ring) and two (outer ring) easily lost, to account for the valence.

Electron Rings

With this formula it is possible to go on building up model atoms for all 92 (or more) elements. The valence pattern is elaborated by the postulate that a ring of 8 electrons forms the most stable configuration possible, and that the inert gases, beginning with neon, have that number in their outer rings. Other elements seek to achieve that configuration, and compounds which achieve it are the most stable.

For example, fluorine, needing but one electron to achieve stability, finds it by combining with sodium, while sodium, with an electron to lose, is likewise rendered stable by the combination. The tranquility of the housewife, when the resulting compound poisons her insect pests, does not enter into atomic theory.

Electronic power heating and some of the new adhesives will be applied to glued wood construction after the war and will make household furniture stronger, more durable and less costly.

Million Organic Compounds From Oil

▶ MORE THAN a million new organic compounds may be produced in the future from petroleum and natural gas, declared Dr. Gustav Egloff of the Universal Oil Products Corporation of Chicago at a recent meeting here of the Los Angeles Section of the American Chemical Society.

Natural gas and petroleum, he stated, are veritable treasure troves of paraffin, olefin, acetylene, cycloparaffin, cyclo-olefin, and aromatic hydrocarbons that open vast vistas in chemical research which have been only faintly explored. Individual compounds, such as isopentane, isooctane, triptane, isobutylene, butadiene, toluene, and styrene, and chemical compounds such as phenols, cresols, organic acids, resins, plastics, explosives, synthetic rubber, and many other derivatives are being produced from petroleum.

The industries based on the newer petroleum chemistry, involving aliphatic hydrocarbons as base materials, have infinitely greater possibilities than the industries based on coal tar chemistry, he declared, even though it is estimated that coal tar has served as a source of about 500,000 derivatives. Coal-tar hydrocarbons are mainly aromatic in character, and this limits the number of derivatives which can be produced from them.

Answers to Chem Quiz on Page 19

A. Isaac Babbitt (1799-1862), English metallurgist, invented **Babbitt Metal**, for anti-friction bearings. It originally consisted of 24 parts tin, 8 parts antimony, 4 parts copper. In later compositions the proportion of tin is often considerably higher.

B. Johann Rudolf Glauber (1604-1668), German alchemist and nostrum seller, first described **Glauber's Salt**, $Na_2SO_4 \cdot 10\,H_2O$, and made extravagant claims for its curative properties. We are indebted to him for modern methods of preparing hydrochloric and nitric acids and many common inorganic salts.

C. Victor Grignard (1871-1935), French chemist, Professor of Chemistry at Nancy, was awarded the Nobel Prize in 1912 for his discovery of the **Grignard Reaction** and preparation of organo-magnesium and similar compounds. His reagents facilitate the building up of complex organic compounds.

D. William Nicol (1768?-1851), Scotch physicist and mineralogist, invented the **Nicol Prism** and set two of them in a pair of tongs so arranged that they would allow light polarized by one prism to be analyzed by the other. Nicol was a skillful lapidary, and cut lenses for his microscope from garnets and other precious stones.

E. William Prout (1785-1850), English physician, worked in physiological chemistry and discovered that the gastric juice contains HCl. His name is linked with **Prout's Hypothesis**, originally published anonymously, suggesting that all chemical elements may be composed of hydrogen.

Synthetic Chemical Treatment Makes Crippled Rise and Walk

New Chemical Aspects of Medicine

by JANE STAFFORD

Medical advances important to relieve human suffering are made known in these reports.

Paralysis Treated

➤ ENCOURAGING results with a new treatment to restore muscle functioning in patients crippled by paralysis, rheumatoid arthritis and injury or infection are reported by Dr. Herman Kabat, of the U. S. Public Health Service.

An elderly woman confined for six years to bed and wheel chair because of rheumatoid arthritis was able after two weeks of treatment to stand up and walk.

A man paralyzed on his right side for 17 years was able, 24 hours after starting the treatment, for the first time in many years, to touch the top of his head, the opposite shoulder, the opposite buttock, his mouth, chin, put a cigarette in his mouth, lift his shoulder blade and move his hip. After one month of treatment he could stand up straight with both heels on the ground, both knees straight and only slight humping of his back.

The treatment that brought about these and similarly striking improvements in other patients when other treatment had failed consisted in injections under the skin once or twice a day of neostigmine. This synthetic chemical is also known as prostigmine. It has for some years been used successfully to relieve the fatigue and muscle weakness of myasthenia gravis.

Dr. Kabat and Dr. M. E. Knapp, of the University of Minnesota Medical School, in 1943 reported trying it in the treatment of infantile paralysis. They found it produced relaxation of muscle spasm, relief from pain, increase in strength and improvement in muscular coordination in the polio patients. This and other studies suggested to Dr. Kabat that it might prove effective in a variety of conditions in which failure of nerve and muscle functioning was causing crippling and disability.

So far he has tried it upon 53 patients. Some had muscle spasm, contracture, joint weakness, pain and muscular weakness persisting for a long period after sprains, fractures and other injuries or after chronic infection. Some had hemiplegia, which the layman calls a paralytic stroke. Some had Bell's palsy. Others had facial paralysis. Included in the group were five patients with the spastic type of cerebral palsy. Rheumatoid arthritis and bursitis of the shoulder were the other conditions.

"Improvement in range of motion, relief from pain and increase in strength and endurance may occur rapidly," Dr. Kabat reports.

What percentage of patients suffering from these conditions can be helped by the neostigmine treatment cannot be stated at present. Further

study is needed to determine this. Patients in whom active inflammation, loss of innervation or bony or fibrous consolidation of a joint is the primary cause of the disability cannot be expected to benefit from the treatment.

"The results have been encouraging enough to warrant further investigation," Dr. Kabat states, adding that an evaluation of the treatment is now being made.

How neostigmine achieves its results is not definitely known. It is known to act on the central nervous system to inhibit or block nerve messages that would cause spasm and excessive tone or tension of muscles.

It may also facilitate formation of new pathways in the central nervous system. Such formation of new pathways for messages to and from muscles is generally considered part of the mechanism of recovery of function following brain damage and resulting paralysis. In these cases the possibilities of neostigmine proving effective will be distinctly limited, Dr. Kabat points out. It can only help within the limits imposed by the irreversible brain damage and the possibilities for formation of new nerve pathways to the abnormally functioning muscles.

Anti-Cancer Vitamin

➤ DISCOVERY that one of the new B vitamins has anti-cancer activity is reported by four researchers of Mount Sinai Hospital of New York City, Drs. R. Leuchtenberger, C. Leuchtenberger, D. Laszlo and R. Lewisohn.

The discovery was made in studies with mice. It has not at present any application to cancer in humans. The researchers make that very clear, but of course the group hopes the discovery will turn out to be useful for treating human cancers.

The vitamin used has been called folic acid but at present scientists are calling it the L. casei factor. Tiny doses of this were injected into the veins of 89 mice that had spontaneous breast cancers. The injections were given daily for four to six weeks.

The cancers disappeared completely in 38 of the mice, or 43%, and 49 of the mice are still living. Of 60 cancerous mice that did not get the vitamin, no tumor disappeared, only 20 are living, and 14 developed new tumors. Only one new tumor was observed among the treated mice.

Whether the vitamin will have the same effect on cancer in humans is not known at present. At this time it is not possible to make tests on humans because there is not enough of the vitamin available. It is a relatively new vitamin. Its chemical structure is not known so it cannot be manufactured in large quantities the way some of the other B vitamins can be. It is a difficult, costly procedure to extract it from natural sources and the yield is minute, about on the order of one part vitamin from 100,000 parts of source material.

How this vitamin acts to cause disappearance of cancer in mice is not known, either. The Mount Sinai researchers during the past seven years have found anti-cancer activity in a number of extracts such as material from spleen, yeast and barley. Suspecting that the anti-cancer material might be a vitamin, they investigated this rather new member of the vitamin B complex, the L. casei factor, with the results now reported.

Artificial Eyes of Plastic

➤ THANKS TO three Army dental officers skilled in making false teeth of plastic material, artificial eyes of plastic instead of glass are now being created for wounded veterans and soldiers inducted with glass eyes.

The plastic looks so much like the natural eye that it is difficult to tell them apart. Skilful tinting and anatomical construction account for part of the natural appearance.

Exact fitting of the plastic eye into the socket makes considerable movement possible and this avoids the staring look of some glass eyes. The plastic eye is lighter than a glass eye and soldier patients who have worn both say the plastic eyes feel better.

Important additional advantage is the fact that the plastic eyes are practically indestructible. Glass eyes break easily if dropped. Plastic eyes are also less expensive. One can be made for something less than $5 and rivals the custom-made glass eye that may cost up to $300.

The three dental officers who are credited with this latest Army medical development are Capt. Stanley F. Erpf, of San Francisco; Major Milton S. Wirtz, of Latimer, Ia.; and Major Victor H. Dietz, of Chicago.

Capt. Erpf got to work on the problem while stationed in a hospital in England where he encountered a soldier who had to wait four weeks to get a glass eye from a supply depot, then dropped and broke it the next day, and was faced with another long wait for a second eye.

About the same time Major Wirtz at Camp Crowder had a dental technician who lost an eye. He could not be fitted with a stock eye and even after he had been sent to Chicago to get a custom-built eye the result was not very good. Major Wirtz thought he could make him a better one out of the plastic material used in dentistry.

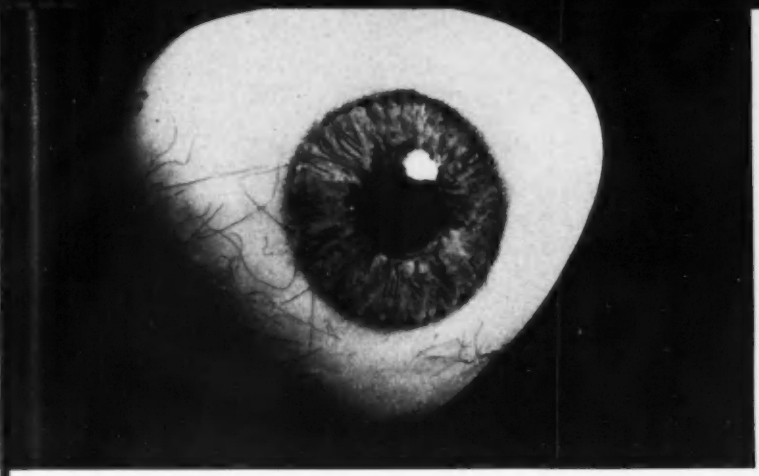
Major Dietz, meanwhile, was experimenting with various dental plastics while stationed at Atlantic City, N. J.

On orders from the Office of the Surgeon General, the three were brought to Valley Forge General Hospital, Phoenixville, Pa., to found the artificial eye laboratory. Within six months they had perfected their techniques so that they could train other men in 30 days to make plastic eyes. Each of these three has now been assigned to other areas in the country to continue experimentation and to train still more technicians in the art of making plastic eyes.

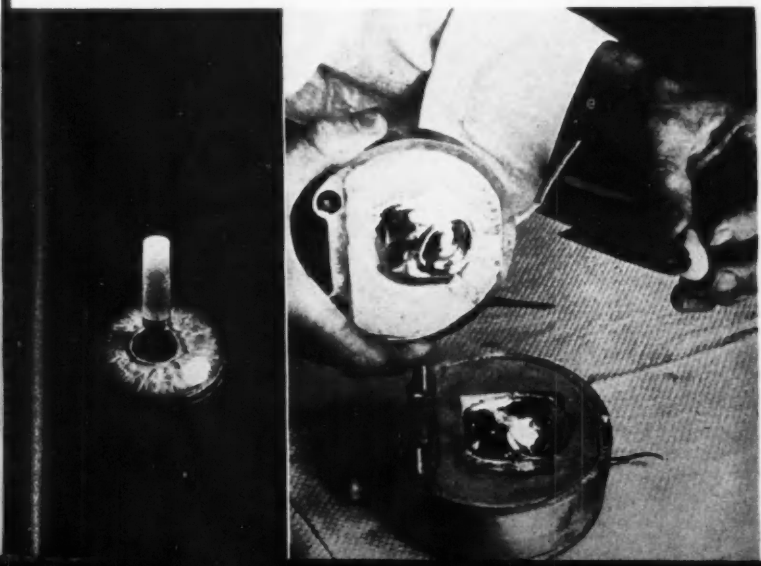
Penicillin Lozenges

➤ GIVING PATIENTS penicillin lozenges to dissolve in their mouths like cough drops is an effective method of using the mold chemical to combat strep sore throat, trench mouth and other mouth and throat infections, two British scientists, Dr. Alexander B. MacGregor and Dr. David A. Long, report in the British Medical Journal.

Pain, fever and disease germs were banished in 24 hours in some cases. All the trench mouth patients, 25 at the time of the report, were free of symptoms within 24 hours, and within five days their mouths had completely healed and they could stop the medicine. Up to three and one-half months later there were no relapses, although the British doctors point out that procedures to eliminate gum pockets and stagnation areas will be



▸ *How plastic eyes are made is shown in these official Army photographs. First a thin disk is painted to duplicate the iris in the patient's natural eye color. Then this is backed with a black disk to simulate the pupil, combined with a magnifier to enhance pattern and color. This eye button is shown lower left. Lower right portrays the baking of the acrylic plastic eyeball. The finished artificial eye is shown above.*



necessary to prevent reinfection at a later date.

In cases of acute streptococcal tonsillitis there was "great relief" in 24 hours and within 48 hours all the patients were free of fever. A grown person severely ill with scarlet fever began taking solid food within 24 hours after the lozenge treatment was started.

No other treatment was given, not even mouth washes, to these and the trench mouth patients.

Hope that the lozenges might clear up the chronic carrier state was doomed to disappointment, however. Streptococcus germs were banished from the throats of the carriers while they were taking the lozenges, but in most of the patients the germs returned soon after the treatment was stopped. A medical student, however, was kept free of the carrier state long enough to finsh his training in obstetrics, which the doctors point to as of practical value.

The lozenges also proved effective in combating germs in surgical cases such as tonsillectomies, tooth extractions and the like.

The lozenges, three-fourths of an inch square by one-eighth of an inch thick, are made of gelatin and penicillin with a small amount of preservative. They have a "very slightly bitter taste" which apparently is not noticeable when there is any infection in the mouth or throat. Well persons who tried the lozenges did not find the bitterness "actively unpleasant."

The lozenge is put in the cheek and left there to dissolve without chewing or sucking. As soon as one has entirely dissolved, the patient takes another. One is taken at bedtime and during the night if the patient awakens. One patient by mistake ate 10 of them during the first five minutes of treatment, but otherwise there was no trouble getting patients, even children, to take the lozenges as directed.

Gallbladder Colic Relieved

➤ THE EXCRUCIATING pain of an attack of gallbladder colic can be quickly relieved by a medicine already known for the relief it gives in angina pectoris and bronchial asthma, Dr. Arthur Gladstone and Dr. Louis Goodman, of the University of Vermont College of Medicine, report in the Journal of the American Medical Association.

The medicine is called theophylline ethylenediamine or aminophylline. It is given by slow injection into the patient's vein and has relieved patients on whom morphine had no effect. The Vermont doctors believe that its pain-relieving effect is due to its relaxing antispasmodic action on the muscles of the biliary tract and perhaps on the gallbladder itself. It is not a cure for gallbladder disease but the Vermont scientists believe its pain-relieving potentialities in gallbladder colic have been overlooked.

The production of soybeans in the United States rose from 3,000,000 bushels in 1920 to nearly 200,000,000 bushels in 1943.

Approximately 1,800 native American plants were used by the aboriginal Indians of the Americas for food and drink; some, such as the potato, corn, tomato, lima bean, and squash, are now staples in the American diet.

➤ *COLLAPSIBLE container for drinking water, approved for American soldiers in the tropics, keeps contents sterile and cool. The semi-porous material of which it is made permits slow leakage through its walls as it hangs in the wind, illustrated above, and the evaporation lowers the temperature of the water.*

* * *

➤ *PORTABLE electroplater, a new improved electrolytic brush, can be used to electroplate immovable objects without dismantling them. The picture shows the brush in use. Electroplating compounds are available for use with it in gold, silver, copper, nickel, cadmium and chromium.*

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